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Dwight E. Nunn
Vice President

April 2, 2002

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C., 20555-0001

Subject: Docket Nos. 50-361 and 50-362
15-day Response to NRC Bulletin 2002-01
Reactor Pressure Vessel Head Degradation and
Reactor Coolant Pressure Boundary Integrity
San Onofre Nuclear Generating Station, Units 2 and 3

References: See Enclosure

Dear Sir or Madam:

This letter provides the Southern California Edison Company (SCE) 15-day response to NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity" (reference 1) for San Onofre Nuclear Generating Station (SONGS) Units 2 and 3. The information requested in NRC Bulletin 2002-01, Items 1.A through 1.E, and the SCE responses are provided below:

1.A. A summary of the reactor pressure vessel head inspection and maintenance programs that have been implemented at your plant.

SCE Response

The SONGS Reactor Pressure Vessel Heads (RPVH) have reflective stainless steel insulation which was installed prior to operation (1982 for Unit 2 and 1983 for Unit 3). This insulation precludes 100 percent bare metal inspections and has not been fully removed for inspection purposes since initial installation. In support of the SONGS Alloy-600 monitoring program, the RPVH insulation was modified in 1993 to allow for partial removal during each refueling outage. This modification permits direct visual inspection of the peripheral 34 (of the 102) RPVH penetrations and approximately one half of the RPVH surface area. For each of the last five refueling outages, a minimum of two inspectors, familiar with the nozzle locations, installation configuration, and the types of indications resulting from primary water stress corrosion cracking (PWSCC) (extremely small leakrates) have inspected each accessible nozzle. All obstructions impairing direct observation of the crevice between Alloy 600 penetrations and the vessel were removed, with the exception of the central nozzles on the reactor head.

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These inspections have never identified an indication of leakage originating from under the insulation nor have there been any findings of corrosion or boric acid deposits that might indicate or promote corrosion of the RPVH surface.

The inner portion of RPVH insulation, approximately 5 feet in radius, has remained in-place since original installation. This section includes a gap between the RPVH surface and the insulation that varies from near contact at the center to several inches further out on the radius. There have been no indications observed of reactor coolant leakage migrating from under the permanent insulation towards the areas exposed for inspection, nor has there been any observation of boric acid extrusion through crevices between insulation panels or Control Element Drive Mechanism (CEDM) penetrations.

Required In Service Inspections (ISI) have been performed in the upper RPVH area with the insulation left in-place. Those inspections have consisted of visual tests VT-2 for leakage at operating pressures. CEDM ventilation ducts are normally in place during these inspections.

Activities performed during refueling maintenance include procedural requirements to identify signs of operational leakage for technical evaluation. This activity has been proceduralized since 1988 in response to Generic Letter 88-05. This program consists of both walkdowns with qualified engineers and requirements to document observation of boric acid leaks or deposits. Relevant results from these inspections are discussed in response to question 1.C below. However, none of these observations have involved boric acid leaks originating under the RPVH insulation. SCE has never found boric acid deposits that would be indicative of through wall CEDM penetration leakage.

In summary, the combination of partial RPVH inspections, boric acid inspections and maintenance programs provides assurance that there is no corrosive process or degradation which undermines the material condition of the SONGS Unit 2 or Unit 3 RPVH.

1.B. An evaluation of the ability of your inspection and maintenance programs to identify degradation of the reactor pressure vessel head including, thinning, pitting, or other forms of degradation such as the degradation of the reactor pressure vessel head observed at Davis-Besse.

SCE Response

Penetration Cracking

Previous RPVH inspections performed at SONGS have relied on evidence of Reactor Coolant System (RCS) leakage as an indication of the potential for RPVH degradation. Therefore, RPVH penetration cracking, which has not grown through the penetration wall or attachment welds, would not be detected. However, defects that are not through wall, can not create the corrosive environment necessary to produce degradation such as observed at Davis-Besse. In the upcoming refueling outages for Unit 2 (May 2002) and Unit 3 (January 2003), under-head inspections capable of detecting partial and through wall cracks will be performed. Additionally, SCE is planning to perform above the head visual inspections. The details of those inspections are discussed in response to item 1.D below.

Corrosion

Degradation of the RPVH base metal can be initiated by leakage of fluids such as boric acid from external sources, or by reactor coolant leakage originating from a through-wall crack in a RPVH penetration. Degradation can reliably be identified during a visual inspection. In addition, the potential for degradation can also be identified by evidence of boric acid and/or corrosion product deposits. Degradation under insulation or erosion/corrosion below the RPVH surface will be associated with a proportional accumulation and transport of corrosion products around and away from the corrosion site. As discussed below, the existing SONGS inspection and maintenance programs rely on both direct RPVH surface inspections and detection of corrosion products to identify either the existence of, or the potential for RPVH degradation.

External Sources of Boric Acid Leakage

The SONGS Boric Acid Leak Inspection Procedure provides a mechanism for any person finding more than a trace of boric acid to document the finding in an Action Request (AR) which will then initiate the leak assessment program process. This process will result in engineering evaluations of the surrounding equipment for possible corrosion, appropriate corrective actions to stop the leakage, and cleaning of affected surfaces.

Boric acid walkdown inspections are performed, in accordance with the "Boric Acid Leak Inspection" procedure, in hot pressurized conditions preceding each refueling outage and for most outages that are scheduled to extend for more than 4 days. These walkdowns include inspection of CEDM vent valves and the surrounding areas above the RPVH. RPVH disassembly by maintenance personnel exposes the instrument mechanical seal assemblies such that any in-service leakage would be detected and documented in an AR in accordance with the boric acid inspection program. RPVH disassembly also exposes the external RPVH insulation surfaces to visual inspection. Although this insulation surface is not a procedurally targeted inspection area, personnel performing RPVH area maintenance and the Alloy-600 penetration inspections work in close proximity to these surfaces and will identify any indication of boric acid leakage.

Therefore, routine refueling activities will detect boric acid leakage originating from any of the mechanical connections located above the insulation, which could lead to RPVH surface corrosion. If leakage is detected, an AR is initiated and appropriate engineering evaluations, corrective maintenance, and cleaning of deposits are accomplished.

There have been no observations of boric acid leakage originating above the RPVH or of boric acid deposits found on the RPVH insulation surface which might have led to measurable RPVH surface corrosion. (A summary of boric acid spillage is provided in 1.C.)

RPVH Surface Inspections

Since 1993 SONGS has performed an effective visual inspection of approximately 1/2 of the external RPVH surface (bare metal inspection) each refueling. There has been no evidence of any external RPVH corrosion or active boric acid leakage found during these inspections.

Detection of corrosion due to boric acid leakage under the remaining insulation depends on the radial location and the amount of leakage. Small leaks under insulated regions near the exposed portion of the RPVH would be evident during the refueling inspections. Corrosion

in areas closer to the center of the RPVH would require a larger amount of leakage to be detected. Therefore, while small areas of corrosion near the center may not have been detected by past inspections, the existing inspections would have detected an aggressive corrosive environment under insulating material long before structurally significant wastage could occur. This is consistent with information contained in Section 6 of NUREG/CR 6245 (reference 4). Due to the limited space between the RPVH and the insulation, any large boric acid accumulation would be forced to either extrude up the gap between the nozzles and the insulation or migrate downward to the peripheral areas of the RPVH. In either event, the boric acid would become visible to the normal inspection and maintenance activities.

Industry Experience

Inspections of RPVH penetrations and RPVH surfaces throughout the industry as a result of Bulletin 2001-01 indicate that a significant amount of boric acid will accumulate on the RPVH prior to degradation of the RPVH. Several sites have identified residual boron deposits in the form of streaks on the surface of the RPVH down to and including the peripheral area with no indications of carbon steel wastage from these residual boron deposits.

Monitoring Plant Operation

Previous industry studies and operating experience have consistently indicated that leakage over more than one operating cycle would be required to produce structurally significant corrosion. SCE is capable of monitoring small increases in RCS leak rate and there has been no significant unexplained growth in nominal RCS leak rates at SONGS since the last inspections. This adds to SCE's confidence that there has been no significant change in RPVH conditions since the last inspections, particularly with respect to an unexpectedly aggressive corrosion/erosion environment.

Because the report of causal factors at Davis-Besse indicated that containment atmosphere monitor particulate filters was a potential indicator, SCE reviewed 32 weekly particulate filters [2 channels per unit, 2(3)-7804 and 2(3)-7807]. There has been no increase in filter change frequency due to filter clogging problems which are routinely changed out on a weekly basis, no visual indication of moisture on the filters (the sample lines are heat traced), and no unusual buildup of debris on the filters.

Conclusion

Based on the results of previous inspections, SCE has a high degree of confidence that there is no degradation of the SONGS RPVH which could challenge structural integrity in the current operating cycles.

1.C. A description of any conditions identified (chemical deposits, head degradation) through the inspection and maintenance programs described in 1.A. that could have led to degradation and the corrective actions taken to address such conditions.

SCE Response

In previous cycles of operation for both Units 2 and 3, spills estimated to be several gallons of RCS at refueling boron concentrations occurred during the CEDM venting process. Any spillage from the CEDM vents must migrate down approximately 20 feet of CEDMs and supports, through the lower RPVH lift rig baffle plate and through the RPVH insulation crevices before reaching the RPVH surface. The torturous path will distribute the spill area and minimize accumulations directly on the RPVH. This is confirmed by routine inspections, which have found trace amounts of boric acid on either the RPVH insulation or on the RPVH surface. Venting practices have been improved to minimize the potential for accidental spills. Current CEDM venting operations limit spillage of reactor coolant onto the upper RPVH area such that the nominal spillage is estimated to be less than one gallon for the entire venting operation (91 CEDM housings).

There have been a number of occurrences of CEDM vent valve leaks following the venting operation prior to plant restarts. These leaks have been very minor in volume and they are always corrected before returning to power operation. There has been one small CEDM vent valve leak detected following plant operation. This occurred on Unit 3 in 1992. The observed boric acid deposits were limited to the area adjacent to the vent valve and well away from RPVH surfaces. CEDM vent valve maintenance procedures and inspections have been effective in preventing subsequent leakage during plant operation.

In March 1991, a Unit 2 incore instrument developed a 0.15 gpm leak into the movable detector guide path. This leakage was channeled into the transfer canisters approximately 20 feet above the RPVH before exiting the system. This leakage existed for 17 days before the Unit was shutdown. Inspection revealed that some of the RCS water had leaked onto the upper RPVH lift rig and dripped down towards the RPVH. Full power critical boron concentrations were less than 350 ppm during the leak period and little evidence of dried boric acid was found during the cleanup. No damage to RPVH or lift rig components was observed. The movable incore instrument guide paths were sealed, and later eliminated to preclude a reoccurrence.

There have been two occurrences of inadvertent containment spray actuation at Unit 2, but neither of these events deposited more than trace amounts of boric acid onto the RPVH surfaces. This was due to the limited spray flow, and presence of missile shields above the RPVH. This has been confirmed by subsequent inspections of containment equipment (which exhibited only minor dusting of dry boric acid crystals) as well as the subsequent (partial) bare metal examinations that found no accumulation of boric acid on the RPVH surface. Work practices have been improved to minimize the probability of a reoccurrence.

There have never been any unresolved indications of boric acid deposits found on the RPVH during the Alloy-600 inspections. The last Alloy-600 program inspections of the RPVH penetrations were performed in October 2000 for Unit 2 and January 2001 for Unit 3.

In summary, there have been no indications of through wall leakage in RPVH penetrations, nor has there been any observation of boric acid deposits that might have led to corrosion of the RPVH. Inspection results following operational events that could create deposits on the RPVH surface have been evaluated and all deposits of boric acid have been thoroughly cleaned. Corrective measures have been implemented to minimize the potential for reoccurrence of operational leaks.

1.D. The schedule, plans, and basis for future inspections of the reactor pressure vessel head and penetration nozzles. This should include the inspection method(s), scope, frequency, qualification requirements, and acceptance criteria.

SCE Response

SONGS Unit 2 is scheduled for refueling in May 2002, and SONGS Unit 3 is scheduled for refueling in January 2003. As committed to by the response to NRC Bulletin 2001-01 (reference 2), SCE will perform either qualified volumetric inspection, or a qualified wetted surface inspection on all of the 102 RPVH penetrations. The inspection techniques that will be applied to the inside diameter of the RPVH penetrations have been successfully demonstrated on the EPRI mock-ups that were constructed in support of Generic Letter 97-01. SCE will apply the acceptance criteria contained in a letter from the NRC staff to the Nuclear Energy Institute (NEI) (reference 3).

In addition to that commitment, SCE plans to perform an effective visual inspection of 100 percent of the RPVH nozzle penetrations that is capable of detecting and discriminating small amounts of boric acid deposits from nozzle leaks. This visual will not be compromised by the presence of insulation. This inspection will be performed in conjunction with a modification to the RPVH insulation that will allow for routine effective visual inspections in the future. Any indication of boric acid that could be attributed to RPVH penetration cracking will be reconciled with under-head inspection results and repaired accordingly.

While not considered necessary to ensure RPVH integrity, SCE is also working with Westinghouse to develop a capability to assess the potential presence of a corrosion cavity in the vicinity of a through wall crack. While the resolution of such a tool is uncertain at this time, SCE does expect that this information, combined with above head and under head inspection data, will provide additional confidence in the integrity of low alloy steel surrounding any affected penetrations.

Inspection plans for subsequent refueling outages will include effective visual inspections, as discussed above and may include additional under head inspections depending on the results of the Cycle 12 refueling outage inspections and recommendations that may be developed by the Materials Reliability Project of the Electric Power Research Institute.

1.E. The conclusion regarding whether there is reasonable assurance that regulatory requirements are currently being met (see the Applicable Regulatory Requirements, provided in NRC Bulletin 2002-01). This discussion should also explain your basis for concluding that the inspections discussed in response to Item 1.D. will provide reasonable assurance that these regulatory requirements will continue to be met. Include the following specific information in this discussion:

1) If your evaluation does not support the conclusion that there is reasonable assurance that regulatory requirements are being met, discuss your plans for shutdown and inspection.

2) If your evaluation supports the conclusion that there is reasonable assurance that regulatory requirements are being met, provide your basis for concluding that all regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.

SCE Response

Current Compliance with Applicable Regulatory Requirements
San Onofre Units 2 and 3 were built to the ASME Code, Section III, 1971 Edition and the pre-service examinations were performed to the requirements of the 1974 Edition of the ASME Code, Section XI, with Addenda through Summer, 1975. During the first 10-year interval, SCE followed the 1977 Edition of Section XI and all Addenda through Summer 1979 for the examination of Class 1 components and equipment. Currently SCE is in the second 10-year inspection interval and is following the 1989 Edition of the ASME Code with no Addenda.

As documented in the SONGS Units 2 and 3 Updated Final Safety Analysis Report, SONGS Units 2 and 3 were designed to meet General Design Criteria 14, 31, and 32. Section 17 of the UFSAR also incorporates the Quality Assurance Topical Report by reference. The QA Topical Report indicates that SCE performs audits to assure compliance with Appendix B criteria V, IX, and XVI and that any deviations identified during these audits are appropriately resolved in accordance with the corrective action program.

None of the inspections or surveillances which have been performed to meet the ASME Code, to comply with the SONGS Generic Letter 88-05 program, or the additional inspections performed on the RPVH have indicated that any leakage or boric acid build up exists on the RPVH. Therefore, SCE concludes there is reasonable assurance that SONGS Units 2 and 3 are currently meeting all applicable regulatory requirements, as discussed in Bulletin 2002-01.

Continued Compliance with Applicable Regulatory Requirements
As discussed in Item 1.D, SCE will perform either a qualified volumetric inspection, or a qualified wetted surface inspection on all of the 102 RPVH penetrations and an effective visual inspection. These inspections will be performed during the Unit 2 refueling outage, which is scheduled to begin in less than 2 months. Because, as stated above, there is

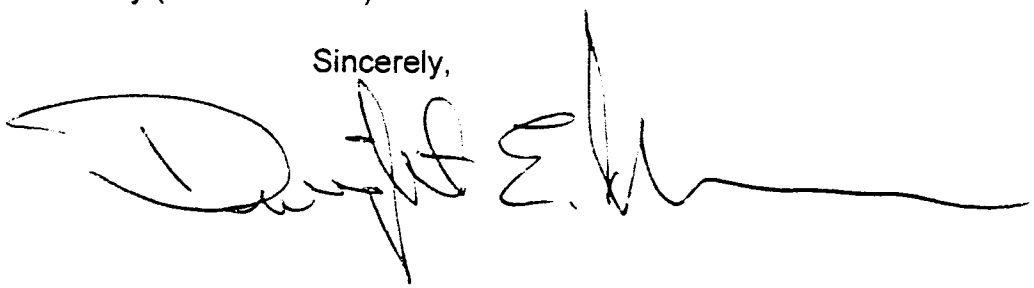
reasonable assurance that all regulatory requirements are being met, there is no reason to shut Unit 2 down prior to its scheduled outage start date (May 20, 2002).

The SONGS Unit 3 outage is scheduled to begin in January of 2003. As stated above, there is reasonable assurance that Unit 3 is currently meeting all regulatory requirements. Therefore, there is no reason for a premature shutdown of Unit 3. Additionally, following the evaluation of the inspection results at Unit 2 this decision will be reassessed based on the material condition of the Unit 2 RPVH.

The UT and ECT examinations that will be performed during the Cycle 12 refueling outages will be used to further characterize the material condition of the RPVH at Unit 2 and Unit 3. Also, during the Cycle 12 refueling outages, SCE is planning to modify the RPVH insulation to allow effective visual inspections, as discussed in 1.D to be performed at each subsequent refueling outage. These subsequent effective visual inspections will provide reasonable assurance that all regulatory requirements will continue to be met during the future operation of Units 2 and 3.

If you have any questions or would like additional information concerning this subject, please call Mr. Jack Rainsberry (949-368-7420).

Sincerely,



State of California
County of San Diego

Subscribed and sworn to (or affirmed) before me this 2nd day of

April, 2002.

By: Frances M. Thurber

Enclosure

cc: E. W. Merschoff, Regional Administrator, NRC Region IV
L. Raghavan, NRC Project Manager, San Onofre Units 2, and 3
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 & 3

Enclosure to the SCE 15-day Response to NRC Bulletin 2002-01

References:

1) NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," dated March 18, 2002

2) Letter from D. E. Nunn (SCE) to the Document Control Desk (NRC) dated August 31, 2001; Subject: Docket Nos. 50-361 and 50-362, 30-day Response to NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles, San Onofre Nuclear Generating Station, Units 2 and 3"

3) Letter from Jack Strosnider (NRC), Office of NRR, to Alex Marion (NEI), dated September 24, 2001; Subject: "Flaw Evaluation Criteria"

4) NUREG/CR-6245, "Assessment of Pressurized Water Reactor Control Rod Drive Mechanism Nozzle Cracking"