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April 15, 2013

10 CFR 2.206

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

**San Onofre Nuclear Generating Station, Units 2 and 3  
Docket Nos. 50-361 and 50-362**

**Subject:** Response to April 4, 2013 Friends of the Earth Submittal of MHI Root Cause Analysis Report for the 10 CFR 2.206 Petition Review Process

Dear Sir:

Friends of the Earth (FOE) currently has pending before the NRC a petition pursuant to 10 CFR § 2.206, alleging that Southern California Edison Company (SCE) violated 10 CFR § 50.59 by not requesting a license amendment for the replacement steam generators (RSGs) for San Onofre Nuclear Generating Station (SONGS). On April 4, 2013, counsel for FOE submitted a letter to the NRC Petition Review Board, attaching and making allegations related to the Root Cause Analysis (RCA) and Supplemental Technical Evaluation Report (STER) prepared by the vendor of the RSGs, Mitsubishi Heavy Industries (MHI). On behalf of SCE, we are submitting this response to FOE's letter.

FOE's letter alleges that the RCA demonstrates that SCE foresaw the high likelihood of fluid elastic instability (FEI) in the RSGs in 2005-2006, that SCE knew about design problems during the engineering design phase of the RSGs, and that SCE had knowledge of design defects prior to conducting its § 50.59 evaluations of the RSGs. Based upon those allegations, FOE's letter accuses SCE of making "false representations" to the NRC in its January 9, 2013 response to FOE's 2.206 petition, and suggests that the NRC should further investigate SCE's response and earlier representations.

As discussed in the attachment to this letter, the accusations in FOE's letter are baseless. FOE has lifted statements out of context from the RCA and STER, and has ignored numerous statements in those reports that refute FOE accusations. The RCA and STER demonstrate that SCE did not know of any defects in the design of the RSGs and was not aware of the potential for FEI in 2005-2006. Accordingly, the NRC should reject the arguments contained in the FOE

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letter, and should reject FOE's 2.206 petition for the reasons set forth in SCE's earlier submission. Additionally, the NRC should admonish FOE for making scurrilous and irresponsible accusations against SCE in FOE's April 4 letter.

Additionally, FOE's letter and its attachment contain a number of other statements that are not accurate. However, such misstatements (like most of the FOE's letter) are not material to FOE's 2.206 petition and we have not attempted to correct them here. Our silence should not be construed as agreement with FOE's statements.

Sincerely,



Steven P. Frantz

Attachment – Analysis of Allegations in FOE's Letter of April 4, 2013

cc: S. Bahadur, Chairman, NRC Petition Review Board  
B. J. Benney, NRC SONGS Petition Manager  
R. W. Borchardt, NRC Executive Director for Operations  
A. T. Howell, Regional Administrator, NRC Region IV  
D. H. Dorman, Co-Chairman, NRC SONGS Oversight Panel  
R. Hall, NRC Project Manager, San Onofre Units 2 and 3  
G. G. Warnick, NRC Senior Resident Inspector, San Onofre Units 2 and 3

## ATTACHMENT

### ANALYSIS OF ALLEGATIONS IN FOE'S LETTER OF APRIL 4, 2013

#### FOE Allegation

The RCA “supports the proposition that SCE foresaw the high likelihood that FEI and other tube excitation mechanisms would result from the design changes.” (FOE letter, p. 3)

“The RCA demonstrates that SCE was aware of the high void fraction and, accordingly, the increased risk of FEI at least as early as the 2005–2006 period . . . .” (FOE letter, p. 3)

“Specifically, the new information contained in the RCA demonstrates that SCE should have deduced that the RSG design, through a high void fraction and therefore increased risk of FEI, would risk adversely affecting the design function of the RSGs’ reactor coolant pressure boundary.” (FOE letter, p. 3)

“SCE was aware that the void fraction of the RSGs was high, a known precursor to FEI, and decided to proceed despite this knowledge.” (FOE letter, p. 4)

#### Facts

FOE’s allegation that SCE knew that the design of the RSGs would lead to an unacceptably high void fraction and FEI is refuted by the RCA itself.

FOE’s letter ignores numerous statements in the RCA, which sets forth MHI’s evaluation of the causes of the tube-to-tube wear (TTW). The RCA notes that the thermal-hydraulic condition of the replacement steam generators “was judged acceptable” and that the thermal-hydraulic “analysis (FIT-III) did not indicate the necessity to reduce the high steam quality (void fraction).”<sup>1</sup> The RCA goes on to state that the stability ratio (SR) was less than 1 (indicating that FEI would not occur) and that there would be “no excessive wear.”<sup>2</sup> Significantly, FOE does not identify anything in the RCA or the STER that indicates that SCE was “aware of” or “foresaw the high likelihood” of FEI in the RSGs.

In the design review process, SCE asked MHI to conduct an analysis to determine whether the void fraction estimated by MHI’s computer model was acceptable, or, if not, to propose a design change to address it. In response, MHI assured SCE that, based on its own review and analysis, the maximum void fraction that MHI expected to occur was acceptable, did not require additional design changes or measures, and that the RSGs would perform as warranted.

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<sup>1</sup> MHI RCA, p. 41.

<sup>2</sup> *Id.*

Specifically, MHI reported that its computer model predicted a maximum void fraction of less than 95%.<sup>3</sup> As discussed below with respect to the next allegation by MHI, MHI stated that such a void fraction would not cause problems, and that it did not need to make design changes to reduce the maximum void fraction.<sup>4</sup> MHI evaluated possible design changes to reduce the maximum void fraction, but reported that these changes would have a negligible impact on void fraction, which its computer model had predicted was acceptable without those changes.<sup>5</sup>

In sum, according to MHI, “at the time of design of the replacement steam generators, SCE and MHI had concluded that the replacement steam generator design was optimized for the SONGS application and that the replacement steam generators had greater margin against U-bend tube vibration and wear than other similar steam generators.”<sup>6</sup> FOE’s assertion that SCE knew that the design would lead to an unacceptably high void fraction and FEI is grossly incorrect. MHI never informed SCE that the maximum void fraction estimated by MHI could contribute to FEI or the failure of the RSG tubes. SCE would never, and did not, accept a design that it believed would impact public safety or impair reliability.

### **FOE Allegation**

The RCA “reports that the joint SCE/MHI AVB [anti-vibration bar] Design Team rejected changes in the design to reduce the void fraction because the change would have had regulatory consequences.” (FOE letter, p. 3)

### **Facts**

The RCA states that “the AVB Design Team recognized that the design for the SONGS RSGs resulted in higher steam quality (void fraction) than previous designs and had considered making changes to the design to reduce the void fraction. . . .”<sup>7</sup> As discussed above, the RCA does *not* state that the maximum void fraction was considered too high, or that a design change was necessary to mitigate that condition. In fact, the RCA states:

Together, the AVB Design Team concluded that the SONGS RSGs had more tube vibration margin than the comparison plant, which had experienced only a small number

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<sup>3</sup> This fact is recognized by FOE, as discussed in the Declaration of John Large in Support of 2.206 Petition by Friends of the Earth (Mar. 27, 2013), p. 8.

<sup>4</sup> Furthermore, as discussed in the STER (pp. 22-28), all of the tubes with TTW due to FEI occurred in a region where the void fraction exceeded 0.993, based upon calculations used in 2012 using the ATHOS code rather than the FIT-III code. In contrast, the maximum void fraction calculated by MHI during the design phase using the FIT-III code was less than 0.95, which is substantially less than the void fraction associated with FEI in the RSGs.

<sup>5</sup> In fact, as was learned after the outages, MHI’s computer code was used in a manner that was not properly validated and underpredicted the maximum void fraction. STER, p. 21

<sup>6</sup> Letter from Edmund Baumgartner (Mitsubishi Nuclear Energy Services) to Arthur T. Howell (NRC) (Feb. 25, 2013) (ML13057A012) (Baumgartner letter), p. 3.

<sup>7</sup> MHI RCA, p. 22.

of tube wear occurrences. This conclusion was due to the following considerations: (i) SONGS RSG tubes are larger, have thicker walls, and are stiffer than those of the comparison plant; (ii) the SONGS distances between AVB tube supports are shorter than those at the comparison plant; (iii) SONGS has 12 AVB tube supports where the comparison plant only has 10; (iv) SONGS's tube-to-AVB gap requirement was more stringent than that of the comparison plant.<sup>8</sup>

The STER provides further details, noting that:

The RSGs for the comparison plant had reported 22 tubes with U-bend wear after the third operating cycle (July 2005). The end product was a design for the SONGS RSGs with more AVB supports and shorter spans in the U-bend region than the comparison plant, along with effective zero tube-to-AVB gaps during operation. The resulting tube vibration potential was judged to be ~70% that of the comparison plant.<sup>9</sup>

FOE also veers far from the truth in asserting that SCE rejected possible design changes that could have resolved the high void fraction concern. In fact, MHI concluded that the design changes it considered would not have had any material impact on maximum void fraction or tube vibration. As discussed in the STER:

In the May 2005 Design Review meeting, MHI presented an RSG performance calculation showing high projected void fraction. It was decided that MHI would perform a parametric analysis to determine how the void fraction could be reduced while maintaining the other design requirements.

Over the next five months, MHI evaluated alternative design modifications to increase the RSG circulation ratio (and thereby reduce the maximum void fraction). The design alternatives included a larger downcomer, larger TSP [tube support plate] flow area, and removing one TSP. None of these alternatives had a large enough effect on the maximum void fraction to justify such a significant change.

However, the net result of the effort was to select the 2V x 3 AVB design from among several competing AVB configurations, which had a smaller pressure loss than the competing concepts, but the reduction in maximum void fraction was negligible. The 2V x 3 AVB design provided significant design margin for minimizing tube vibration. In October 2005 the AVB Design Team agreed that the RSG design was optimized for the SONGS application. At the time of shipment of the SONGS RSGs it was believed that they had greater margin against U-bend tube vibration and wear than other similar SGs.<sup>10</sup>

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<sup>8</sup> RCA, pp. 17-18.

<sup>9</sup> STER, p. 54.

<sup>10</sup> STER, p. 56. Similar statements appear at MHI RCA, p. 22.

As MHI's letter accompanying its submission of the RCA to the NRC states, the "other alternatives under consideration did not have a large enough effect on the maximum thermal-hydraulic conditions to justify the significant change to the design."<sup>11</sup>

The design changes that MHI considered not only were judged by MHI to be ineffective, but according to MHI had unacceptable consequences. As stated by MHI:

The reference in the RCA to "unacceptable consequences" reflects the fact that those potential alternatives that were not implemented, in addition to being largely ineffective in increasing the circulation ratio, had negative safety impacts on other aspects of the design (e.g., reducing tube bundle structural integrity and reducing tube support plate structural margin). Consequently, MHI and SCE concluded that the trade-offs associated with these evaluated changes did not justify changing the design in light of the minimal benefit in reducing thermal-hydraulic conditions.<sup>12</sup>

FOE does not identify any proposed design change that was rejected due to its regulatory consequences.

### **FOE Allegation**

"[T]he RCA shows SCE to have known about the design problems during the engineering design phase." (FOE letter, p. 4)

"[T]he RCA demonstrates that SCE had knowledge of the defects inherent to the design of the RSGs prior to conducting the § 50.59 evaluations." (FOE letter, p. 4)

### **Facts**

As discussed above, SCE did not know of design problems or design defects during the design phase of the RSGs.

This point is discussed further in MHI's letter transmitting the RCA and the STER to the NRC:

The AVB Design Team used AVBs that had proven successful in previous steam generator designs, including large steam generators similar to the SONGS replacement steam generators. Conservatively, the SONGS replacement steam generator design used more AVBs than other large steam generators of similar design. Because of this feature and other conservative aspects of the SONGS design, the proposed SONGS replacement steam generator design was judged by the AVB Design Team to have a lower potential for vibration wear than that for other large steam generator designs.<sup>13</sup>

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<sup>11</sup> Baumgartner letter, p. 3.

<sup>12</sup> *Id.*

<sup>13</sup> *See id.*, p. 2.

As stated above, MHI concluded that:

Thus, at the time of design of the replacement steam generators, SCE and MHI had concluded that the replacement steam generator design was optimized for the SONGS application and that the replacement steam generators had greater margin against U-bend tube vibration and wear than other similar steam generators.<sup>14</sup>

FOE's letter does not identify any "design problems" or "defects" known by SCE during the 2005-2006 period. The only specific issue identified in the FOE letter relates to void fraction. As discussed above, the maximum calculated void fraction of less than 95% was not thought in 2005-2006 to be unacceptably high, and there were no known design problems or defects related to void fraction at that time.

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<sup>14</sup> *Id.*, p. 3.