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Director
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March 16, 2011 10CFR50.55a

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

Subject: Docket Nos. 50-361 and 50-362
Third Ten-Year Inservice Inspection (ISI) Interval
Relief Request ISI-3-31, Flaw Evaluation of High-Energy Schedule 10s Emergency Core Cooling System Piping
San Onofre Nuclear Generating Station, Units 2 and 3

Reference: Letter from R. St Onge (SCE) to the U.S. Nuclear Regulatory Commission (NRC) dated May 19, 2010; Subject: Docket Nos. 50-361 and 50-362, Third Ten-Year Inservice Inspection (ISI) Interval, Relief Request ISI-3-31, Flaw Evaluation of High-Energy Schedule 10s Emergency Core Cooling System Piping San Onofre Nuclear Generating Station, Units 2 and 3

Dear Sir or Madam,

By letter dated May 19, 2010 (Reference) Southern California Edison submitted Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-31 in accordance with 10 CFR 50.55a(a)(3)(ii). The purpose of the referenced relief request is to allow use of alternative evaluation criteria for temporary acceptance of flaws in High-Energy Class 2 and 3 Emergency Core Cooling System (ECCS) Schedule 10s piping.

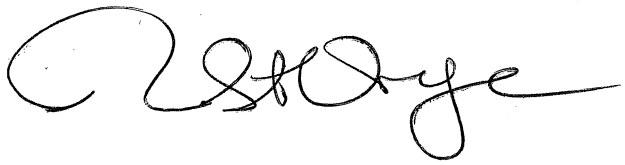
By e-mail dated February 3, 2011, the NRC requested additional information in support of review of Relief Request ISI-3-31. Responses to the NRC request for additional information are provided in the Enclosure to this letter.

This letter and the enclosure contain no new commitments.

P.O. Box 128
San Clemente, CA 92674

Should you have any questions, please contact Ms. Linda T. Conklin at (949) 368-9443.

Sincerely,



Enclosure: as stated

cc: E. E. Collins, Regional Administrator, NRC Region IV
R. Hall, NRC Project Manager, San Onofre Units 2 and 3
G. G. Warnick, NRC Senior Resident Inspector, San Onofre Units 2 and 3

Enclosure

Response to Request for Additional Information
Regarding
10 CFR 50.55a Request ISI-3-31
Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(ii)
Hardship
Without Compensating Increase in Level of Quality or Safety

RESPONSES TO NRC RAIs REGARDING SCE RELIEF REQUEST ISI-3-31

FLAW EVALUATION OF HIGH ENERGY SCHEDULE 10S
EMERGENCY CORE COOLING SYSTEM PIPING

The NRC staff provided questions regarding SCE's proposed Third Ten-Year Inservice Inspection Interval Relief Request ISI-3-31 by e-mail dated February 3, 2011. The questions refer to SCE responses to a previous Request for Additional Information, which SCE submitted to the NRC on December 20, 2010.

NRC Question 1:

The licensee's response to NRC Question 3(2)(b) stated that through-wall flaws will be observed by daily walkdowns to confirm that the analysis conditions remain valid and that flaw size stays within the allowable limit. (1) Clarify whether the allowable through-wall flaw sizes in Tables 2 and 3 of the relief request are applicable to partial through-wall flaws. (2) If the allowable flaw sizes in Tables 2 and 3 are applicable to partial through-wall flaws, discuss how the daily walkdowns can monitor those flaws that are opened to the outside surface of the pipe (i.e., do the walkdowns require physical measurement of the flaw length?). (3) Discuss whether any candidate pipe is located in the high radiation area such that daily walkdowns or monthly ultrasonic examinations cannot be performed. In such situations, describe how inspections will be performed.

SCE Response:

(1) Yes, the allowable through-wall flaw sizes in Tables 2 and 3 of the relief request are applicable to partial through-wall flaws. Based on the evaluation procedures of ASME Section XI Appendix C, the allowable through-wall flaw sizes in Tables 2 and 3 are bounding to part-through wall flaws for a given flaw length and therefore are applicable to part through-wall flaws. Specifically, the structural evaluation attached to the relief request calculates the allowable flaw sizes for flaw depths equal to 100% of the pipe wall thickness.

Therefore, this evaluation bounds flaw depths less than 100% of the wall thickness.

(2) Daily walkdowns are for monitoring of leaking flaws and detecting any new leaking flaws in regions that are being monitored. Flaws that have penetrated the pipe wall will be treated as leaking flaws regardless of leak rate. Any through-wall leaking flaws will be marked so that the change in flaw length can be measured and the change in leak rate recorded.

Known flaws, including, flaws that are open to the outside surface but have not penetrated the pipe wall will be inspected every 30 days using NDE. The surface length of the part through-wall flaws will be determined at each inspection to trend the flaw growth and to compare the measured lengths with the allowable through-wall lengths to justify continued operation.

(3) The ECCS lines to which this relief request applies are located outside containment and would be accessible for daily or monthly inspections under Code Case N-513-2. There are two short lengths of ECCS piping in the containment emergency sump that see high temperature post-LOCA (Items 5 and 10 in Table 1 of the Relief Request); however, these lines are not accessible during normal plant operation and, as such, Edison is removing the portions of these lines that are inside containment from the scope of the Relief Request. Edison has walked down the outside containment ECCS lines (as part of extent of condition walkdowns in late 2009, and subsequent walkdowns to monitor for these lines for through-wall leaks); these lines are accessible and, therefore, could be monitored consistent with Code Case and this relief request.

NRC Question 2:

The licensee's response to NRC Question 5 stated that "…If ultrasonic testing is impractical due to geometry, obstructions, or other reasons, then physical measurement of the flaw will be performed…" The staff does not object to the physical measurement in the above situation. (1) However, discuss why eddy current testing or penetrant testing was not considered if ultrasonic testing is impractical. (2) The flaw length on the inside surface of the pipe may be longer than the outside surface of the pipe. The flaw may grow more at the inside surface than at the outside surface. Discuss how the physical measurement can detect the flaw growth of the through-wall flaw to ensure structural integrity of the degraded pipe.

SCE Response:

(1) Ultrasonic testing is the industry standard NDE technique for volumetric examination of piping. Surface examination by penetrant testing has been used on this type of pipe and will be used for the ECCS piping on a case-by-case basis where practical. While volumetric examination using Eddy Current Testing (ECT) would likely be impractical, surface examination using ECT may be used for ECCS piping on a case-by-case basis where practical. Surface examination by penetrant examination or ECT is considered to be a form of physical measurement.

(2) Schedule 10s pipe is relatively thin. For example, the 24-inch pipe has a wall thickness of 0.25 inch only. The extent of ID lengths is not expected to significantly exceed the OD length before through-wall penetration and visible leakage occurs. Additionally, most observed degradation initiates on the OD surface so that OD lengths are expected to be greater than ID length at time of discovery. An additional margin of 0.25 inch will be added to the measured OD flaw length prior to comparison to allowable flaw lengths in Tables 2 and 3 of the Relief Request to account for uncertainty on length sizing.

NRC Question 3:

The licensee's response to NRC Question 6(2) stated that if the flaw growth is found to be at a greater rate than originally expected and operation for the operating cycle would no longer be justified, the licensee would perform a mid-cycle repair. Similarly, the licensee's response to NRC Question 13(3) stated that "…a repair or replacement shall be performed no later than when the predicted flaw size from periodic inspection or flaw growth analysis exceeds the acceptance criteria, or the next scheduled outage, whichever occurs first…". (1) Specify the acceptance criteria for the flaw growth analysis and the acceptable flaw growth rate that corresponds to each flaw size in Tables 2 and 3. Is there a growth rate that will be considered unacceptable? (2) If a detected flaw in a candidate pipe is the same size as the allowable flaw size, discuss whether the degraded pipe will be repaired or replaced at the time of discovery.

SCE Response:

1) An unacceptable growth rate is one where the flaw length is projected to exceed the allowable flaw length before the next 30-day inspection required by Code Case N-513-2 or the next scheduled outage, whichever is less.

2) If the detected flaw length upon discovery is the same size as the allowable flaw length, then the degraded pipe will be repaired or replaced.

   Note that the allowable flaw lengths provided in Tables 2 and 3 of the relief request were calculated conservatively based on the bounding stresses for each line. Therefore, using these allowable lengths to evaluate flaws at any location in the piping system is conservative. No location-specific flaw lengths will be used to justify acceptance of flaws in the piping system. The allowable flaw lengths provided in Tables 2 and 3 of the relief request will be used to justify acceptance of planar flaws at all locations in the affected piping.

NRC Question 4:

The licensee's response to NRC Question 7(1) stated that "…[t]here would be sufficient time following an accident initiation to evacuate personnel from areas near any known through wall flaws…" The staff does not think the evacuation of personnel is sufficient. The staff still has concerns regarding the application of the proposed relief request to flaws that result in hot steam leakage because of personnel safety and the potential that the steam may affect nearby piping systems or electrical equipment. In addition, the exiting steam may prevent physical measurement or ultrasonic examination. (1) Propose additional measures that would contain and isolate exiting steam to safeguard plant personnel and nearby safety-related components. (2) Describe how the flaw size can be measured or inspected accurately considering the presence of exiting hot steam.

SCE Response:

(1) SCE believes that no additional measures to contain or isolate any potential steam leaks are necessary. This is based on estimations of the potential leak rates, velocities and associated impingement forces. The following example illustrates how these factors would be determined:

The maximum allowable leak rate for any flaw based on contribution to control room dose consequences would be approximately 0.25 gpm (5.57×10^{-4} ft^3/sec). Using an allowable leak rate of 0.25 gpm as an input, the computer program PICEP can be used to calculate the opening area of a through-wall flaw under internal pressure, thermal expansion and deadweight loading. For example, a crack opening area of 3.72×10^{-5} ft^2 was calculated for a 24 inch sch 10s pipe (wall thickness of 0.25 inch) with internal pressure of 110 psi and at a temperature of 225°F.

The calculated force from the resulting mass flow rate of 0.0331 lbs/sec at a velocity of 15 ft/sec is 0.0331 x 15 / 32.2 = 0.015 lbs which will not cause damage to adjacent equipment.

Furthermore, no significant increase in the surrounding air temperature is expected due to the leaking water based on the small amount of released mass (0.0331 lbs/sec) and the corresponding energy.

Therefore, it is concluded that no damage to adjacent equipment is expected based on the mass rate and the velocity of the leaking fluid. This evaluation will be included in the prompt operability evaluation on a case-by-case basis.

As stated in SCE's previous response to NRC questions regarding relief request ISI-3-31, dated December 20, 2010, the only time there would be

steam leakage through potential flaws in the affected piping is in post-accident conditions, following a Recirculation Actuation Signal. As such, there would be sufficient time following an accident initiation to evacuate personnel from areas near any known through wall flaw. Thus there would be no effect on personnel safety from leakage through such flaws.

(2) Higher temperatures only occur following a loss-of-coolant accident. Therefore, flaw measurements can be accurately made, and leakage safely monitored, during normal inspection periods. During a postulated accident, the time at which containment sump water temperatures exceed 200°F will be less than 14 hours. At all other times, the affected piping is moderate energy.

The allowable flaw sizes in Tables 2 and 3 of the proposed relief request consider the worst-case faulted loads. Based on the above, SCE does not intend to perform inspections immediately following an accident until such time as accident recovery conditions allow for safe access to perform such inspections.

NRC Question 5:

In the last paragraph on page 9 of the enclosure to the December 20, 2010, letter, the licensee's response to NRC Question 7(2) states that "…a non-leaking flaw may develop leakage during the period between inspections. However, it is not expected to reach the critical size within one month period based on either the fracture mechanics or the leak rate evaluation…" The staff is concerned about the structural integrity of the candidate pipes if the allowable flaw sizes in Tables 2 and 3 of the relief request are the same as the associated critical crack size. Provide the ratio (safety margin) between each allowable flaw size in Tables 2 and 3 of the relief request and the corresponding critical crack size.

SCE Response:

The allowable flaw lengths in the relief request are smaller than the critical flaw size for the piping. The allowable flaw lengths are based on a through-wall flaw evaluation following the procedures of ASME Section XI Appendix C. The allowable flaw lengths maintain the full structural factors on load for upset (Level B) and faulted (Level D) loading conditions specified in C-2620 of Appendix C as required by Code Case N-513-2. The ratio of allowable length and critical length for the piping listed in Tables 2 and 3 of the relief request are attached. Tables 5.1 and 5.2 provide the critical / allowable size ratio for circumferential flaws and axial flaws, respectively.

Table 5.1
Critical / Allowable Flaw Size Ratio
For Circumferential Flaws

RR Item No.	Line Number	Section Description	Pipe Size (NPS)	Allowable Flaw Length ℓ_{allow} (inch)		Critical Flaw Length ℓ_{crit} (inch)		Ratio ℓ_{crit}/ℓ_{allow}	
				SAW and SMAW	TIG and Wrought	SAW and SMAW	TIG and Wrought	SAW And SMAW	TIG and Wrought
1	1204ML108/ 003/007/009	Between Valves MU001, MU003, MU007, MU010, and MU062	10	15.19	18.70	16.70	19.31	1.10	1.03
			16	15.97	22.95	19.07	23.66	1.19	1.03
			24	24.38	36.47	29.20	38.51	1.20	1.06
2	1204ML007	Between Valves MU007 & HPSI Pump P017	8	12.41	15.53	13.41	16.65	1.08	1.07
3	1204ML009	Between Valves MU010, MU011 & HPSI Pump P018	8	2.94	7.12	6.06	9.63	2.06	1.35
4	1204ML003	Between Valves MU003 & HV9303	24	11.17	34.79	15.87	39.61	1.42	1.14
5	1204ML003	Between Valve HV9303 & Containment Emergency Sump*	24	11.17	34.79	15.87	39.61	1.42	1.14
6	1204ML003	Between Valve MU062 & Containment Spray Pump P012	14	n/a	n/a	n/a	n/a	n/a	n/a
			16	15.97	22.95	19.07	23.66	1.19	1.03
7	1204ML109/ 004/031/008/ 010	Between Valves MU002, MU004, MU009, MU011, MU005 & MU199	10	13.03	16.65	15.24	18.78	1.17	1.13
			16	19.2	25.53	22.78	29.04	1.19	1.14
			24	17.22	33.01	25.24	38.40	1.47	1.16
8	1204ML008	Between Valve MU009 & HPSI Pump P019	8	2.94	7.12	6.06	9.63	2.06	1.35
9	1204ML004	Between Valves MU004 and HV9302	24	6.87	21.06	19.40	30.25	2.82	1.44
10	1204ML004	Between Valve HV9302 & Containment Emergency Sump*	24	6.87	21.06	19.40	30.25	2.82	1.44
11	1204ML004	Between Valve MU005 & Containment Spray Pump P013	14	n/a	n/a	n/a	n/a	n/a	n/a
			16	19.2	25.53	22.78	29.04	1.19	1.14
12	1204ML131	Between Valve HV9347 & mini flow tie	4	5.88	7.50	6.57	8.23	1.12	1.10
13	1204ML151	Between Valve HV9306 & mini flow tie	4	3.68	6.14	4.57	7.07	1.24	1.15
14	1204ML180	Between Valve PSV9308 & mini flow tie	2.5	1.65	2.98	2.49	3.73	1.51	1.25
15	1204ML080	Between Valves MU060 & MU068	6	2.60	8.49	4.00	9.93	1.54	1.17

*Outside Containment Only

Table 5.2

Critical / Allowable Flaw Size Ratio For Axial Flaws

Pipe Size (NPS)	Outside Diameter (inch)	Wall Thickness (inch)	Allowable Flaw Length ℓ_{allow} (inch)	Critical Flaw Length ℓ_{crit} (inch)	Ratio ℓ_{crit}/ℓ_{allow}
2.5	2.875	0.12	9.16	22.03	2.40
3	3.5	0.12	8.32	20.04	2.41
4	4.5	0.12	7.35	17.73	2.41
6	6.625	0.134	7.14	17.29	2.42
8	8.625	0.148	7.25	17.60	2.43
10	10.75	0.165	7.62	18.57	2.44
14	14	0.188	8.08	19.79	2.45
16	16	0.188	7.51	18.50	2.46
24	24	0.25	9.32	23.15	2.48

NRC Question 6:

The licensee's response to NRC Question 7(3) stated that "…[t]he current Control Room dose due to a LOCA is 2.8 rem Total Effective Dose Equivalent (TEDE). This is only 2.2 rem TEDE below the 5 rem TEDE limit. ESF leakage of approximately 0.25 gpm has been estimated to result in a Control Room Dose equal to the 5 rem TEDE limit. Thus any leakage resulting from a potential flaw in the Schedule 10 piping affected by Relief Request ISI-3-31, when added to existing known leakage, must be limited to 0.25 gpm…" (1) Discuss (and provide the basis for your conclusion) whether any of the allowable flaw sizes in Tables 2 and 3 will result in leakage more than 0.25 gpm? (2) If the leakage from a flaw exceeds 0.25 gpm, discuss whether the affected pipe will be repaired at the time of discovery (i.e., a potential for a mid-cycle repair). (3) It appears that 0.25 gpm is an acceptance criterion beyond which a leaking pipe will not be allowed to remain in service. Explain why this criterion is not part of the proposed alternative. (4) Discuss how the RCS leakage detection systems can detect and quantify a leak rate of 0.25 gpm from the candidate piping systems in the relief request.

SCE Response:

(1) The allowable flaw sizes in Tables 2 and 3 are based on the structural evaluation described in the code case. The prompt operability evaluation (POD) will include an additional evaluation to calculate the allowable flaw size that causes a leak rate under post-LOCA conditions (considering a 120-day mission time) that would result in control room dose consequences exceeding GDC 19 limits (approximately 0.25 gpm). It is possible that the allowable flaw sizes from Tables 2 and 3 would be greater than an allowable flaw size calculated based on leakage considerations, particularly for large diameter pipes. The smaller of the two allowable flaw sizes will be used as the allowable flaw size in the POD.

(2) The degraded pipe will be repaired or replaced if the observed or calculated leak rate exceeds 0.25 gpm.

(3) The leak rate acceptance criterion is not explicitly part of the proposed alternative. SCE is obligated, however, to consider through-wall flaw leakage rates and associated dose consequences in the Prompt Operability Determination for any such flaws. As a result, the final allowable flaw length for any flaw to remain in service will be the smaller of (A) and (B) below:

(A) The allowable flaw size provided in Tables 2 and 3 of the Relief Request, and
(B) The allowable flaw size that causes a maximum leak rate of approximately 0.25 gpm. This evaluation shall be included as part of the POD.

(4) Leakage detection and monitoring of known leaking flaws will be performed by physical inspections. Leakage will be monitored daily.

NRC Question 7:

The licensee's response to NRC Question 14 stated that "…Code Case N-513-2 does provide provisions where planar flaw analysis may be used to evaluate non-planar flaws under the requirements of 3(d)(1) or 3(f) of the case. This will allow the use of the relief request to evaluate non-planar flaws, such as localized pitting, or intergranular attack, if such degradation is detected…" However, the allowable flaw sizes in Tables 2 and 3 in the relief request are derived based on the assumption that the flaw is planar, not non planar. Therefore, it appears that the allowable flaw sizes in Tables 2 and 3 of the relief request are not applicable for dispositioning the non-planar flaws in the candidate pipes. If the relief request is applicable to non-planar flaws, provide justification.

SCE Response:

Depending on the extent of localized degradation, a planar flaw evaluation may be used to assess non-planar degradation following the provisions of 3(d)(1) of Code Case N-513-2, which can be summarized as follows:

(A) When the width of wall thinning W_m that exceeds t_{min} is less than or equal to 0.5 times $(R_o t)^{1/2}$, where R_o is the outside pipe radius and t is the wall thickness, the flaw can be classified as a planar and evaluated in accordance with Appendix C. Refer to Figure 2 of Code Case N-513-2.

(B) When the wall thinning does not meet the requirements of (A) above, SCE will apply the provisions of 3.0(d) Items (2), (3) or (4) of Code Case N-513-2.

(C) When there is through-wall penetration along a portion of the thinned wall then SCE will apply the provisions of 3.0(e) of Code Case N-513-2.