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LR-N04-0366

PSEG
Nuclear LLC

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

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING REQUEST FOR AUTHORIZATION TO USE A RISK-INFORMED INSERVICE INSPECTION ALTERNATIVE TO THE ASME BOILER AND PRESSURE VESSEL CODE SECTION XI REQUIREMENTS FOR CLASS 1 AND 2 PIPING
HOPE CREEK GENERATING STATION
DOCKET NO. 50-354

Reference: LR-N04-0036, Request for Authorization to use a Risk-Informed Inservice Inspection Alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 And 2 Piping, dated March 1, 2004

On March 1, 2004, PSEG Nuclear LLC (PSEG) submitted the referenced request regarding a proposed Alternative to utilize a Risk Informed-Inservice Inspection Plan. NRC letter dated August 5, 2004, requested additional information regarding the referenced letter. The information was requested to be submitted by August 18, 2004. Attachment 1 contains PSEG Nuclear's response to the request for additional information. Since the scope of Question 5 expanded from that discussed with the NRC staff at an earlier date, response to Question 5 will be provided under separate cover on or before August 27, 2004.

If you have any questions or require additional information, please contact Mr. Michael Mosier at (856) 339-5434.

Sincerely,

Michael Brothers
Vice President – Site Operations

Attachment

A047

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Attachment 1

Response to NRC Request For Additional Information

HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NO. NFP-57
DOCKET NO. 50-354
REQUEST FOR ADDITIONAL INFORMATION

NRC Question 1:

Regulatory Guide (RG 1.178, *An Approcah for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping, Revision 1, dated September 2003, replaced the original "For Trial Use"* RG dated September 1998. Revision 1 of RG 1.178 includes guidance on what should be included in risk informed-inservice inspection (RI-ISI) submittals, particularly in dealing with probabilistic risk assessment (PRA) issues. Specifically, on page 28 of RG 1.178, the following is stated:

> "A description of the staff and industry reviews performed on the PRA. Limitations, weakness or improvements identified by the reviewers that could change the results of the PRA should be discussed. The resolution of the reviewer comments, or an explanation of the insensitivity of the analysis used to support the submittal to the comment, should be provided."

Section 1.2 of your submittal discussed the HCGS IPE. By letter dated April 23, 1996, the NRC issued a safety evaluation, concluding that the IPE had met the intent of GL88-20, and had identified plant-specific vulnerabilities per the guidance of NUREG-1335. With regard to the IPE, answers to the following are required:

a. What weaknesses were identified?

b. What was done to correct the identified weaknesses or why the uncorrected weaknesses are not relevant to this application?

PSEG Response to Question 1:

In letter LR-N94-070 dated May 31, 1994, PSEG submitted IPE results for Hope Creek Generating Station (HCGS). The only vulnerability identified at the HCGS was a long term loss of Heating Ventilation and Air Conditioning (HVAC) in a limited number of electrical equipment areas. The NRC staff concurred with this finding in enclosure 2 of their safety evaluation report, dated April 23, 1996. Procedure "HC.OP-AB.HVAC-0001", was developed to address this issue, it instructs station personnel to provide alternative cooling methods such as opening doors and bringing in portable fans when the normal cooling mode is not available. With this vulnerability addressed, the IPE results showed that the CDF (Core Damage Frequency) was in the range of 1.0E-5, which is within the industry norm.

NRC Question 2:

In Section 1.2 of your submittal, you identify that an industry peer review was completed in November of 1999. The Section notes that 'most' of the significant findings from this formal peer review were incorporated in Revision 1.3 and that this revision of the PRA model was used in your submittal. Section 1.2 further states that the main comments from the peer review were associated with the treatment of the human action dependencies and the Level 2 Large Early Release Frequency (LERF) sequences timing. While the staff concurs with your expectation that a pessimistic adjustment of the timing of LERF sequences would not impact the consequence rankings, the following information is needed in regard to the human action:

a. Was the peer review comment about human action dependencies corrected by Revision 1.3?

b. If Revision 1.3 did not address the human action dependencies concern (i.e., the dependent Human Error Probabilities (HEPs) are basically unchanged since the peer review), explain why the consequences rankings would likely not be affected by a correction to this issue.

PSEG Response to Question 2:

The industry peer review recommended that we review and correct our treatment of human action dependencies. This recommendation was accepted and implemented. However, after careful review of the implementation of this recommendation in the PRA model revision 1.3, we discovered that one of the corrections has not been implemented. This involves the dependent human action for the miscalibration of temperature control valves HV-2457A and HV-2517A in the A loop of the Safety Auxiliaries Cooling System (SACS), and also for HV-2457B and HV-2517B in the B loop of SACS. Since these pairs of valves are in series, common cause failures due to dependent human actions/miscalibrations are not applicable. If one valve fails due to miscalibration, the loop fails independent of whether or not the other valve fails due to the dependent human action. These CCFs should have been deleted. The impact of not deleting these CCFs is negligible. The CDF value would be slightly lower if this dependency is removed from the model.

NRC Question 3:

Section 3.6.1 indicates that you used the "Simplified Risk Quantification Method" as described in Section 3.7 of the Electric Power Research Institute (EPRI) Topical Report (TR) 112657 in support of your overall risk impact assessment. You selected 1E-08 per weld-year as the pressure boundary failure frequency for a weld with no known degradation mechanism (i.e., low failure potential) and a value of 20 times that (i.e., 2E-07) for a weld with medium failure potential, which is similar to the failure rate used by some of the pilot plants for the EPRI TR, as noted by your citation of References 9 and 14 in the TR.

a. Given this information, a Category 4 weld should have a contribution to CDF of (1E-03) * (1E-08) or 11E-11/year. Assuming that the inspections are 100 percent effective in finding flaws before they progress to a rupture, then the decrease of one weld inspection should result in an increase in CDF of 1.0E-11/year. Table 3.6-1, which presents the risk impact results, indicates a net decrease of seven system RPV Category 4 weld inspections, resulting in a CDF increase of 3.5E-11/year, rather than the expected 7.0E-11/year. Additionally, Table 3.6-1 lists a net increase of four system BE Category 4 weld inspections, resulting in a CDF decrease of 2.0E-11/year, rather than the expected 4.0E-11/year. Clarify this discrepancy.

b. Many of the numerical entries in Table 3.6-1 have the same CDF impact or LERF impact values in the "w/ [with] POD [probability of detection]" column as in the "w/o [without] POD" column, while other entries have different CDF and LERF impact values between the two columns. Explain why the "w/ POD" and "w/o POD" values are sometimes, but not consistently different.

    i. Provide an example calculation of CDF and LERF impact for a Category 4 group of welds in which there is no CDF/LERF impact between the "w POD" and "w/o POD" columns.

<u>PSEG Response to Question 3:</u>

a. It should be noted that a POD value is included in all the risk impact calculations. This includes both the w/ POD case as well as the w/o POD case. In the w/o POD case, the analysis was performed without taking credit for an enhanced inspection effectiveness due to an increased POD from application of the RI-ISI approach. In this case, a POD value of 0.5 is used. This same POD value of 0.5 is used in those cases where no damage mechanism is identified (i.e., Risk Category 4). The example ΔCDF values cited in this question include a POD of 0.5.

b. As explained above, a POD value is considered in all the risk impact calculations, including both the w/ POD case as well as the w/o POD case. An increased POD due to enhanced inspection effectiveness is only applied in those cases where thermal fatigue (TASCS and/or TT) is identified and no other damage mechanism is present. The POD values used in the analysis are summarized below.

DMs	w/ POD Case		w/o POD Case
	Section XI	RI-ISI	Section XI / RI-ISI
TASCS, TT	0.3	0.9	0.5
All Other DMs	0.5	0.5	
No DMs	0.5	0.5	

i. It's believed that the above responses have addressed this concern. The change in CDF due to application of the RI-ISI process was estimated based on the equation presented below. This equation applies to a group of welds that are in the same risk category with the same consequence rank (i.e., same CCDP), and are susceptible to the same degradation mechanisms (i.e., same RF and PODs).

$\Delta R_{CDF} = CCDP*RF*[(POD_S*N_S) - (POD_R*N_R)]$

CCDP	Conditional Core Damage Probability based on the consequence rank assigned for the specific group of welds
RF	Rupture Frequency based on the degradation mechanisms identified for the specific group of welds
POD_S	Probability of Detection associated with the ASME Section XI Code Program and the specific degradation mechanisms identified
POD_R	Probability of Detection associated with the EPRI TR-112657 RI-ISI Program and the specific degradation mechanisms identified
N_S	Number of Inspection Locations in the ASME Section XI Code Program
N_R	Number of Inspection Locations in the EPRI TR-112657 RI-ISI Program

The change in LERF due to application of the RI-ISI process was estimated by substituting the conditional large early release probability (CLERP) for CCDP in the above equation.

<u>NRC Question 4:</u>

Section 2.2 of the submittal lists augmented inspection programs that were considered during the RI-ISI application. Section 6.5 of EPRI TR-112657 also provides a listing of augmented inspection programs, and how they are to be treated in relation to the RI-ISI program. Two programs, applicable to boiling water reactors, are listed in the EPRI

document which are not discussed in Section 2.2 of your submittal. Specifically, NRC Bulletin 88-08 (Thermal Stresses in Piping Connected to Reactor Coolant Systems) and NRC Generic Letter 89-13 (Service Water Integrity Program) were identified. Describe how these two augmented inspection programs were treated with respect to the HCGS RI-ISI program.

PSEG Response to Question 4:

Section 2.2 of the template submittal documents all existing plant augmented inspection programs that address common piping with the RI-ISI application. The HCGS ISI Program does not presently include a formal plant augmented inspection program for NRC Bulletin 88-08. Based upon the review of piping systems for HCGS, PSEG determined that no further actions were required. This was documented in our letter, NLR-N88155 dated September 23, 1988. However, the thermal fatigue concerns addressed in NRC Bulletin 88-08 were explicitly considered in the HCGS RI-ISI application.

The scope of the RI-ISI application for the HCGS is Class 1 and 2 piping. Since the service water system (primarily Class 3) is not in the RI-ISI scope for the HCGS, this application has no bearing on the plant's augmented inspection program for Generic Letter 89-13.

NRC Question 5:

As explained in paragraph 4 of Section 3.5, and reiterated in the notes to Table 3.5 of the March 1, 2004 submittal, you have included 6 non-Category A Intergranular Stress Corrosion Cracking (IGSCC)-susceptible welds in the scope of the RI-ISI program. This was done even though you indicated that the IGSCC inspection program was to be unaffected by the RI-ISI program and welds only susceptible to IGSCC are excluded from the RI-ISI program scope such that IGSCC susceptibility was no longer considered in the risk-ranking of a piping segment. Therefore, the scope of piping segments left for consideration under the RI-ISI program include only IGSCC welds susceptible to multiple degradation mechanisms.

> Section 3.6.4 of EPRI TR-112657 provides two alternatives for selecting weld locations. The alternatives are also discussed in ASME Code Cases N-560 and N-578, but the staff has only endorsed the alternatives as described in the EPRI Topical Report and has not endorsed the Code Cases. The selection alternatives discussed in Section 3.6.4.1 and 3.6.4.2 correspond to discussions in ASME Code Case N-560 and N578 respectively. In Section 3.6.4.1 of the TR, there are explicit provisions for crediting an augmented inspection program examination as an RI-ISI examination, provided that the location is a high risk location (Risk Categories 1, 2, or 3), and that no more than half of the total RI-ISI examinations may be "borrowed" from these programs. Section 3.6.5.1 expands on this

discussion by noting that the locations of these "borrowed" examinations must be identical to those called out in the augmented inspection program, and not one that is within the scope of the program, but not identified for inspection. Section 3.6.4.2 of the TR requires that the augmented inspection program remain completely as is. The "number, location, and frequency" would remain the same. These programs are not subsumed into the EPRI RI-ISI program (with the exception of Category A IGSCC welds). The section further states that elements determined to have degradation mechanisms, other than those in the Flow Accelerated Corrosion (FAC) and IGSCC inspection programs are to be included in the RI-ISI program. The number and locations are to be selected according to the RI-ISI program. There is no provision in this section which allows augmented inspections to be credited toward the total number of RI-ISI examinations.

Section 3.6.5.2 of the TR, which discusses the attributes of a Code Case N-578 examination, only reiterates the provisions for welds that are under the jurisdiction of an augmented inspection program. No additional information is given. For welds not under one of these programs, this section provides additional guidance for selection of locations. Again, there is no provision given for crediting these augmented inspection program examinations toward the RI-ISI examination count.

In the first alternative, augmented program elements are fully included in the RI-ISI program but augmented inspections may be credited to satisfy the required number of inspection locations. In the second alternative, augmented program elements (and degradation mechanism) are excluded from the RI-ISI program although discontinued Section XI inspections must still be reflected in the change in risk estimates. There are no provisions in EPRI TR-112657 for mixing the alternatives by excluding the augmented inspection program elements and degradation mechanism but crediting the inspections.

Section 3.5 of your submittal, and the notes to Table 3.5, appear to indicate that you have excluded all augmented program elements from the RI-ISI program but have credited some of the inspections in the RI-ISI program, in essence, mixing the alternatives.

a) Explain how your submittal is in accordance with the approved methodology or justify why any deviation yields a RI-ISI program with an equivalent level of safety as one developed using the approved methodology.

b) Describe, in detail, how the IGSCC (category B through G) program's welds and weld inspections were incorporated into the RI-ISI program. Specifically, indicate the number of welds in the IGSCC program and the number of weld inspections in the program. How were the number of welds available for inspection in the RI-ISI program (i.e., the RI-ISI program population) increased when the welds inspected in the IGSCC augmented program welds were credited as inspections in the RI-ISI program? If the RI-ISI population was not increased by the total number of welds within the IGSCC inspection program, provide a justification for this.

c) From your submittal and the supplemental information you provided, the staff understands that four IGSCC (category B through G) program inspections at weld locations exposed to multiple degradation mechanisms are credited as RI_ISI program inspections. In addition, the staff understands that there are a total of 13 weld locations that are exposed to IGSCC and at least one other degradation mechanism. Confirm or clarify this understanding. Do any of these 13 welds, other than the four that are exposed to multiple degradation mechanisms and undergo IGSCC program inspections which are credited to the RI-ISI program, also receive IGSCC program inspections? If so, explain why the above four inspections were credited to the RI-ISI program, but not any of the other inspections. How many of the 13 welds with IGSCC and at least one other damage mechanism were added to the overall population of RI-ISI welds when the above four IGSCC weld inspections were credited in the RI-ISI program?

d) Confirm that all of the inspections from the augmented inspection programs credited in the RI-ISI program (we understand this to be a total of four) are capable of detecting the additional degradation mechanisms identified at each of the applicable weld locations.

e) From your submittal and the supplemental information you provided, the staff understands that two IGSCC (category B through G) program inspections at weld locations exposed only to the IGSCC degradation mechanism are credited as RI-ISI program inspections. In addition, the staff understands that there are a total of 7 weld locations that are exposed only to the IGSCC degradation mechanism. Confirm or clarify this understanding. Do any of these 7 welds other than the two that are exposed only to the IGSCC degradation mechanismand undergo IGSCC program inspections which are credited to the RI-ISI program also receive IGSCC program inspections? If so, explain why the above two inspections were credited to the RI-ISI program, but not any of the other inspections. How many of the 7 welds exposed only to the IGSCC degradation mechanism were added to the overall population of RI-ISI welds when the above two IGSCC weld inspections were credited in the RI-ISI program?

f) When a weld location from an augmented inspection program is included in the RI-ISI program, the degradation mechanism addressed by the augmented program is assumed to be controlled by that program. That is, the RI-ISI program assumes that the mechanism does not exist because of its control under the augmented program. For welds where IGSCC is the only degradation mechanism, their inclusion in the RI-ISI program would result in them being considered as having no degradation mechanism at all. What welds, if any, would not be inspected in the RI-ISI program as a result of the two borrowed welds discussed in question 5.d? Would any of these preempted weld location inspections subject to degradation mechanisms other than IGSCC, and if so, what is the increase in risk due to their replacement?

PSEG Response to Question 5:

Since the scope of Question 5 expanded from that discussed with the NRC staff at an earlier date, response to Question 5 will be provided under separate cover on or before August 27, 2004.

NRC Question 6:

Section 3 of PSEG's March 1, 2004 submittal states that the RI-ISI program for HCGS will deviate from the EPRI RI-ISI methodology for the assessment for thermal stratification, cycling, and striping (TASCS). State whether or not the revised methodology for assessing TASCS potential is in conformance with the updated criteria described in the EPRI letter to the NRC dated March 28, 2001. Also, confirm that as stated in the March 28, 2001 letter (Available under ADAMS Accession Number ML011070238), once the final material reliability program guidance has been developed, the RI-ISI program will be updated for the evaluation susceptibility to TASCS, as appropriate.

PSEG Response to Question 6:

The last paragraph of Section 3.0 states, in part, "The above criteria have previously been submitted by EPRI for generic approval (Letters dated February 28, 2001 and March 28, 2001, from P.J. O'Regan (EPRI) to DR. B. Sheron (USNRC), "Extension of Risk-Informed Inservice Inspection Methodology"). The methodology used in the Hope Creek RI-ISI application for assessing TASCS potential conforms to these updated criteria."

Final MRP guidance is not currently available and as such PSEG can not predict what impact it may or may not have on the current RI-ISI Program nor NRC's acceptance of the final guidance. It is PSEG intent to review the final guidance and assess its impact on the RI-ISI Program to assure that the RI-ISI Program continues to meet the intent of Reg. Guide 1.174 and represents a robust ISI Program.

NRC Question 7:

Section 2.2 of the submittal states, in part, "[t]he feedwater nozzle-to-safe end weld locations are included in the scope of both the NUREG 0619 Program and the RI-ISI Program. The plant augmented inspection program requirements for these locations are not affected or changed by the RI-ISI Program." Explain if credit has been taken from this augmented program as part of the RI-ISI program. If so, explain the weld selection criteria as compared to EPRI TR-112657, given that NUREG-0619 is not considered as an augmented program in EPRI TR-112657.

PSEG Response to Question 7:

Section 2.2 of the template submittal documents all existing plant augmented inspection programs that address common piping with the RI-ISI application. As stated above, the feedwater nozzle-to-safe end weld locations are included in the scope of both the NUREG 0619 Program and the RI-ISI Program. The plant augmented inspection program requirements for these locations are not affected or changed by the RI-ISI Program. The feedwater nozzle-to-safe end weld locations selected for RI-ISI purposes will be subjected to a volumetric examination for crevice corrosion, in addition to the examinations performed per the plant's NUREG-0619 Program.

NRC Question 8:

Section 3.5 of the submittal states, in part, "[t]he above sampling percentage does not take credit for any inspection locations selected for examination per the plant's augmented inspection program for FAC beyond those selected per the RI-ISI process. It should be noted that no FAC examinations are being credited to satisfy RI-ISI selection requirements. Inspection locations selected for RI-ISI purposes that are in the FAC Program will be subjected to an independent examination to satisfy the RI-ISI Program requirements." Provide information on those selections made by the RI-ISI process that are also included in the augmented FAC program.

PSEG Response to Question 8:

The locations listed in the table below are currently inspected in the plant's FAC Program. Some of these locations were also selected for RI-ISI purposes, either due to the presence of other damage mechanisms, or to satisfy Risk Category 4 selection requirements. As stated above, inspection locations selected for RI-ISI purposes that are in the FAC Program will be subjected to an independent examination to satisfy the RI-ISI Program requirements. A summary of the examination requirements for these locations is provided below.

System	Risk Category	DMs	Weld Count	RI-ISI Selections	Comments
BG	4 (1)	None (FAC)	5	1	The piping weld selected for RI-ISI purposes will be subjected to a volumetric examination independent of the FAC examination performed on this inspection location.
FC	5a (3)	TT, (FAC)	3	1	The piping weld selected for RI-ISI purposes will be subjected to a volumetric examination for thermal fatigue, in addition to the FAC examination performed on this inspection location.
	6a (3)	None (FAC)	8	0	No RI-ISI selections required.
BE	7a (5b)	None (FAC)	4	0	No RI-ISI selections required.
AB	6a (3)	None (FAC)	5	0	No RI-ISI selections required.
AE	2 (1)	TASCS, TT, (FAC)	3	2	The two piping welds selected for RI-ISI purposes will be subjected to a volumetric examination for thermal fatigue, in addition to the FAC examinations performed on these inspection locations.
	2 (1)	TASCS, (FAC)	7	1	The piping weld selected for RI-ISI purposes will be subjected to a volumetric examination for thermal fatigue, in addition to the FAC examination performed on this inspection location.
	2 (1)	TT, (FAC)	2	0	No RI-ISI selections made.
	4 (1)	None (FAC)	23	3	The three piping welds selected for RI-ISI purposes will be subjected to a volumetric examination independent of the FAC examinations performed on these inspection locations.

NRC Question 9:

The second paragraph of Section 3.5.1 states that additional examinations will be conducted during the current outage. Clarify the time frame for second sample examinations.

PSEG Response to Question 9:

Section 3.5.1 states that if unacceptable flaws or relevant conditions are again found similar to the initial problem, the remaining elements identified as susceptible will be examined (i.e., second sample) during the current outage.