DRAFT

RESPONSES TO GG-ISI-002 RAI SET #2

REQUEST FOR ADDITIONAL INFORMATION
RISK-INFORMED INSERVICE INSPECTION RELIEF REQUEST
ENTERGY OPERATIONS, INC.
GRAND GULF NUCLEAR STATION
DOCKET NO. 50-416

1) Regulatory Guide (RG) 1.178 describes one acceptable process for developing a RI-ISI program. Please explain:

   a) How the approach used to analyze piping system failures for the plant specific PRA of pressure boundary failures compares to the approach described in Section 2.1.4 of RG 1.178;

   Response

   The purpose of segments and segment definitions are identical between the ASME Code Case N-716 (N-716) approach and that of the EPRI RI-ISI methodology. In both methodologies, segments are used only as an accounting/tracking tool. That is, whether the weld is tracked individually or as part of a segment, the results of the risk ranking and element selection part of the methodology will not change. In both approaches, whether the segment is small (e.g., a single weld) or large (e.g., many welds), all of the welds will be ranked and then subject to a fixed sampling percentage for determining the size of the inspection population.

   As an example, if the population of high safety significant (HSS) welds is 100, whether they are tracked as ten (10) segments (e.g., ten welds per segment) or two (2) segments (50 welds per segment), all 100 welds would be subject to the element selection process. For example, 25% of HSS welds with susceptibly to a degradation mechanism would be selected for applications and 25% of welds identified as Risk Category 2 would be selected for EPRI RI-ISI applications.

   b) How the process used to assess piping failure potential for the plant-specific probabilistic risk assessment (PRA) of pressure boundary failures compares to the process outlines in Section 2.1.5 of RG 1.178;

   Response

   For application, failure potential is used in two ways:

   1. *Confirm on a plant-specific basis that there is no other piping that should be considered as HSS per Section 2(a) of N-716. [Please see the response to Question 3(c) below and the response to Question 2(c) from the first set of RAIs.]*

   2. *Once the HSS population has been determined for the plant, the failure potential evaluation is identical to that in EPRI TR-112657 as applied to a number of NRC-approved RI-ISI applications. That is, the degradation*

mechanisms assessed, the evaluation criteria (e.g. attributes such as operating temperatures, allowable delta Ts, susceptible materials, flow velocities, etc.) and the failure potential ranking are the same.

c) How the quantitative results of the pipe failure frequency that resulted from the failure potential assessment compares to the weld failure frequencies proposed in Section 5(a) of that are eventually used in your change in risk estimates;

Response

Because the failure frequencies in Section 5(a) of are at the weld level, they are, therefore, substantially smaller than what is used in conducting an internal flooding study in general, and the GGNS internal flooding study, in particular. Another reason the failure frequencies used in the GGNS internal flooding study are larger than the values is because the GGNS internal flooding study includes the impact of flood sources beyond piping (e.g., tanks, pumps, heat exchangers, etc.). For screening purposes, this is conservative from an internal flooding study perspective. It is also conservative from a N-716 perspective because some of these flooding sources and therefore their contribution to failure frequency (e.g., tanks) are not within the N-716 scope of application (i.e., piping).

d) How the consequence evaluation performed as part of the plant-specific PRA of pressure boundary failures compares with the process outlined under Section 2.1.6 of RG 1.178.

Response

The plant-specific PRA of pressure boundary failures is consistent with that discussed in Section 2.1.6 of RG 1.178 in that plant walkdowns were conducted to identify flood initiators and the locations of critical components. Additionally, for each flood zone and/or scenario, the impact of both direct and indirect effects was considered. Direct effects included loss of a train or system (e.g., loss or diversion of flow), an initiating event, or both. Indirect effects included spatial effects such a spray, pipe whip, etc. as well as loss of inventory effects (e.g., loss of a common tank).

2) Please fully define the population of welds to which the 10% guideline is applied. Please explain the following:

a) Is the guideline to examine a minimum 10% of all HSS welds, 10% of all HSS butt welds, 10% of all HSS butt welds $\geq$ 4 NPS, or something else?

Response

Yes, the guideline is to examine a minimum of 10% of HSS welds. For GGNS, this population includes welds that are both less than, equal to, and greater than 4 NPS. It also includes butt welds and sockets welds.

Additionally, a lessons learned from the GGNS application was that the wording of N-716 could be clearer in its intent to require inspection of at least

10% of the reactor coolant pressure boundary (RCPB). While the GGNS application meets this intent, it is also the author's intent to revise N-716 to make this requirement clearer, as well as other lessons learned from its application [see the response to Question 3(a) from the first set of RAIs].

b) What type of inspections can be counted as part of the required population? For example, can visual examinations or wall thickness exams be counted in the 10%?

Response

Per N-716, wall thickness exams as part of the FAC and localized corrosion (excluding crevice corrosion) programs cannot be counted as part of the 10% required population. Because of the nature of the degradation, wall thinning examination for locations potentially susceptible to erosion-cavitation will be conducted.

Per N-716, the requirements for examination of socket welds and smaller bore branch connections (i.e., ≤ 2 NPS) susceptible to thermal fatigue shall be a volumetric exam of the piping base metal within ½ inch of the toe of the weld and a visual of the fitting itself. This is consistent with the requirements of EPRI MRP-146.

Thus, HSS inspections required by N-716 shall be volumetric exams as part of the GGNS application.

c) What percentage of Class 1 butt welds (regardless of NPS) will be inspected in the proposed risk-informed program?

Response

Entergy has selected an 11.5% sample of all Class 1 butt welds regardless of NPS.

3) Under Section 3.4 on Page 10 of 28 of GG-ISI-002, your submittal states, "the risk of implementing this program is expected to remain neutral or decrease when compared to that estimated from current requirements." However, the total change in risk in the table on page 13 of 28 is positive for both CDF and LERF when credit is not taken for improved detection. Please explain why additional inspections were not provided to bring the estimated risk increase to a risk neutral or risk decrease as proposed under Section 3.4.

Response

The GGNS N-716 application will use inspection techniques that are expected to increase the inspection effectiveness as compared to current ASME Section XI requirements. Thus, as shown on page 13 of 28, the expected impact on risk is a risk reduction. The "w/o POD" case provided in the submittal is a sensitivity study and not the true representation of the expected impact on risk of the application. Even so, the "w/o POD" sensitivity study shows that even when not crediting the improved inspection effectiveness, only a small increase in risk would be witnessed.

4) At the top of page 9 of 10, GG-ISI-002 identifies four (4) primary guidelines on selecting inspection locations, or six (6) guidelines if each sub-bullet in (1) is counted as a guideline. Please describe briefly how each of these six guidelines was applied (e.g., how many inspections were influenced by the guideline and if application of the guideline resulted in changes to the original locations) when you were selecting inspection locations at Grand Gulf. Also, discuss whether there were any inspections added due to change in risk considerations.

Response

The process of defining the inspection population of an N-716 application is an iterative process. The first step is to define the scope of HSS welds on a "per system" basis. As a starting point, N-716 requires that 10% of the HSS welds, on a "per system" basis, be selected for inspection (see attached Table 4-1, column entitled "HSS"). The next step is to assure that 10% of Class 1 welds are selected (see attached Table 4-1, column entitled "Class 1"). It should be noted that a lesson learned from the GGNS application is that this requirement could be more clearly stated in N-716 and it is the author's intent to revise the code case to reflect this and other lessons learned, as applicable. The next step is to assure that 25% of locations identified as potentially susceptible to some type of degradation mechanism be selected (see attached Table 4-1, column entitled "DMs"). The next step is to confirm that two thirds of the identified inspections for the RCPB are within the first isolation valve or move inspections from between the two isolation valves to within the first isolation valve to compensate, if necessary (see attached Table 4-1, column entitled "RCPB$^{IF/IV}$"). The next step is to confirm, or select if necessary, so that 10% of the RCPB that lies outside containment is inspected (see attached Table 4-1, column entitled "RCPB^{OC}"). Finally, inspections are chosen so that 10% of the break exclusion region (BER) populations are chosen (see attached Table 4-1, column entitled "BER"). Again, this may have already been accomplished by the preceding criteria, but needs to be confirmed or adjusted accordingly.

Depending upon how the element selection process is ordered, it may be necessary to iterate once or twice to assure the criteria are met. Because of rounding up, the selection being done on a system-by-systems basis, and the multiple criteria, it is expected that a greater than a 10% inspection population will be attained (e.g., GGNS witnessed slightly less than 11%).

With respect to change in risk considerations, no changes to the number or locations of inspection were required.

TABLE 4-1 (1)

ID	System	Selections	HSS	Class 1	DMs	RCPB^{IFIV}	RCPB^{OC}	BER
B13	RPV	Required	4 of 40	4 of 40	2 of 8	n/a	n/a	n/a
		Actual	4 of 40	4 of 40	4 of 8	n/a	n/a	n/a
B21	FW, MS, SD and SP	Required	35 of 347	30 of 300	22 of 87	20	8 of 72	16 of 155
		Actual	35 of 347	32 of 300	26 of 87	21	10 of 72	20 of 155
B33	RCR	Required	20 of 194	20 of 194	n/a	14	n/a	n/a
		Actual	20 of 194	20 of 194	n/a	20	n/a	n/a
C41	SLC	Required	5 of 42	5 of 42	n/a	4	n/a	n/a
		Actual	5 of 42	5 of 42	n/a	4	n/a	n/a
E12	RHR	Required	12 of 114	8 of 79	5 of 17	6	1 of 4	4 of 35
		Actual	13 of 114	8 of 79	5 of 17	7	1 of 4	5 of 35
E21	LPCS	Required	4 of 32	4 of 32	n/a	3	1 of 2	n/a
		Actual	4 of 32	4 of 32	n/a	3	1 of 2	n/a
E22	HPCS	Required	5 of 42	5 of 42	1 of 4	4	1 of 7	n/a
		Actual	5 of 42	5 of 42	2 of 4	4	1 of 7	n/a
E32	MSLC	Required	4 of 31	4 of 31	n/a	n/a	4 of 31	4 of 31
		Actual	4 of 31	4 of 31	n/a	n/a	4 of 31	4 of 31
E38	FWLC	Required	2 of 11	2 of 11	n/a	n/a	2 of 11	n/a
		Actual	2 of 11	2 of 11	n/a	n/a	2 of 11	n/a
E51	RCIC	Required	3 of 24	2 of 12	n/a	2	1 of 2	2 of 18
		Actual	3 of 24	3 of 12	n/a	2	1 of 2	2 of 18
G33	RWCU	Required	14 of 131	10 of 97	n/a	7	1 of 9	9 of 89
		Actual	14 of 131	12 of 97	n/a	10	2 of 9	14 of 89

(1) For columns entitled “HSS”, “Class 1”, “DMs”, “RCPM^{OC}” and “BER”, the information provided is in the format of number of inspections per population of welds (e.g., a 10% requirement for a population of forty (40) welds would be “4 of 40”). For the column entitled RCPB^{IFIV}, this criterion is that 2/3 of the Class 1 inspections be inside the first isolation valve. Thus, this column identifies, on a “per system” basis, how many inspections were required per this criterion (row entitled “Required”) and how many were actually selected to meet this criterion (row entitled “Actual”).

5) In Section 5 of the licensee's submittal, the licensee states that it will implement the RIS_B program during the plant's third period of the current (second) inspection interval by performing 29% of the inspection locations selected for examination per the RIS_B process since 71% of the piping weld examinations required by ASME Section XI have been completed.

a) Please discuss what B-F, B-J, C-F-1, and C-F-2 weld examinations have been completed during the third ISI period of the second interval.

Response

To date Entergy has examined the following number of Class 1 and 2 piping welds in the third period:

B-F = 6

B-J =21

C-F-1 = 0 (GGNS only has 3 C-F-1 welds)

C-F-2 = 24

b) Table IWB-2412-1, allows credit for up to 67% of examinations completed by the end of seven (7) years (second period) in the inspection interval. Please confirm that the plant will perform a minimum of 33% of the RIS_B selected examinations during the third period of the current inspection interval.

Response

Based on the NRC SER dated 20 February 2007, approving Entergy's Request for Relief CEP-GGNS-003, Entergy has suspended piping examinations while developing a Risk Informed ISI program. Entergy has completed examinations in one outage of the third period as well as on-line examinations. To date Entergy has examined 71% of Class 1 and 2 piping welds. Therefore, it is Entergy's intentions to examine 29% of the RIS_B selected examinations during the remainder of the third period of the current (second) inspection interval. Furthermore, Entergy believes that only allowing credit for 67% of the examinations would not be in line with current NRC guidance as demonstrated in the NRC approval of Code Case N-598 in RG 1.147. This Code case allows up to 75% of examinations to be credited during the second inspection period.

c) Describe how the licensee will determine which examinations to perform during the remainder of the second 10-year ISI interval.

Response

Prior to developing the RIS_B Program, GGNS had planned to inspect locations scheduled for examination in the traditional ASME Section XI inspection program. Examination activities during refueling outages are planned far in advance. In general, only designated plant areas and components are accessible for examination during a given refueling outage

due to other ongoing plant maintenance and modification activities. Hence, any location previously scheduled for examination in the third period via the traditional program will remain scheduled for examination in the third period if the location has also been selected for RIS_B Program purposes. To complete the sample size, additional locations will be selected, if necessary, to achieve equal representation of the degradation mechanisms. Other factors such as accessibility and scaffolding requirements will also be factored into the selection process.

6) Please describe how volumetric examinations will be performed. Will, at a minimum, volumetric examinations include the volume required for ASME Section XI examinations? Will ASME Section XI, Appendix VIII qualified examiners and procedures be used for all volumetric exams? Will the examination volume be scanned for both axial and transverse indications for all exams? Please describe and justify your answers.

Response

Volumetric examinations will be performed as required by Table 1 of N-716. The table requires an examination volume as defined in the ASME Section XI IWB figures. This would require examination of at least the ASME Section XI volume. (More volume may be required based on the notes on Table 1.) N-716 does not take any exceptions to the paragraphs of the Code that govern volumetric examinations and the request for alternative does not take exception to any 10 CFR limitations. Therefore, Entergy will examine these welds using the same personnel and procedure requirements as a traditional Section XI piping volumetric examination.

7) Please describe how preservice examinations will be performed for repair/replacement activities.

Response

For preservice examinations, Entergy will follow the rules contained in Section 3.0 of N-716. Welds classified HSS require preservice inspection. The examination volumes, techniques, and procedures shall be in accordance with Table 1. Welds classified as LSS do not require preservice inspection.

8) On Page 10 of 28 the licensee discusses additional examinations. Please describe what will be used to perform the engineering evaluation to determine the cause of any unacceptable flaw or relevant condition. Recent industry practice has been to perform corrective actions (i.e., overlays, replacement, etc.) prior to a root cause being determined (e.g., use of a qualified procedure and personnel).

   a) In some cases no materials are removed for metallurgical analysis. Please discuss the process used for this engineering evaluation, how will it be documented, and will the NRC be involved in the process?

Response

Based on the NRC's questions and recent industry events, Entergy agrees that the process contained in GG-ISI-002 could be difficult to codify as written and difficult to consistently perform and, thus, difficult to regulate. Therefore, Entergy will revise the submittal to use the additional examination criteria contain in N-716, Section 6. These requirements are concise and can be implemented consistently each occurrence. Additionally, these requirements are the same as those that ASME have recently approved in Appendix R.

b) Discuss what process will be used to perform fracture mechanics evaluations

Response

See the response to Question 8a.

d) Discuss under what conditions would there be no additional examinations. Discuss how the licensee will document their justification.

Response

See the response to Question 8a.

9) On page 10 of 28 of GG-ISI-002, the licensee provides guidance in Section 3.3.2, "Program Relief Requests." For program relief requests, the licensee refers to the process outlined for 10 CFR 50.55a that will be used. Please describe the process for assessing limited examination coverage. Discuss whether additional examinations will be performed and whether additional techniques will be used to improve examination coverage. Discuss how the effect on risk of the incomplete examination coverage will be assessed. In what time frame will relief requests be submitted?

Response

Consistent with previously approved RI-ISI submittals (e.g. ANO, Unit 2 SER), Entergy will calculate coverage and use additional examinations or techniques in the same manner it has for traditional Section XI examinations. Experience has shown this process to be weld-specific (e.g., joint configuration). As such, the effect on risk, if any, will not be known until that time. Relief requests will be submitted per the guidance of 10 CFR 50.55a(g)(5)(iv) within one (1) year after the end of the interval.

10) Section 3.3.2 also states that an attempt was made to select locations for examination such that a minimum >90% coverage is attained. Discuss how this attempt was conducted. If less than 90% examination is completed, discuss whether additional weld(s) will be examined to compensate for the limited examination coverage.

Response

As discussed in EPRI TR-112657, accessibility is an important consideration in the element selection process of a RI-ISI application. As such, for the GGNS N-716 application, locations have generally been selected for examination where the desired coverage is achievable. This is typically accomplished by utilizing previous inspection history, plant access considerations, and knowledgeable plant personnel. However, some limitations will not be known until the examination is performed since some locations will be examined for the first time.

In addition, other considerations may take precedence and dictate the selection of locations where greater than 90% examination coverage is physically impossible. This is especially true for element selections where a degradation mechanism may be operative (e.g., risk categories 1, 2, 3 and 5 of EPRI TR-112657). For these locations, elements are generally selected for examination on the basis of predicted degradation severity. For example, in the emergency core cooling system (ECCS) injection lines of PWRs, the piping section immediately upstream of the first isolation check valve is considered susceptible to intergranular stress corrosion cracking (IGSCC), assuming a sufficiently high temperature and oxygenated water supply. The piping element (pipe-to-valve weld) located nearest the heat source will be subjected to the highest temperature (conduction heating). As such, this location will generally be selected for examination since it is considered more susceptible than locations further removed from the heat source, even though a pipe-to-valve weld is inherently more difficult to examine and obtain full coverage than most other configurations (e.g., pipe-to-elbow weld). In this example, less than 90% coverage of this location will yield far more valuable information than 100% coverage of a less susceptible location.

For locations with no identified degradation mechanisms (i.e., similar to risk category 4 of EPRI TR-112657), a greater degree of flexibility exists in choosing inspection locations. As such, if at the time of examination an N-716 element selection is found to be obstructed, a more suitable location may be substituted instead.

Therefore, Entergy will review each instance of limited coverage and take the appropriate steps (e.g., relief requests) consistent with its impact on the basis of the N-716 application.