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CNRO-2007-00026

July 2, 2007

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

SUBJECT: Request for Alternative GG-ISI-002
Response to Request for Additional Information

Grand Gulf Nuclear Station
Docket No. 50-416
License No. NPF-29

REFERENCES:

1. Entergy Operations, Inc. letter CNRO-2006-00043 to the NRC, dated September 22, 2006
2. Entergy Operations, Inc. letter CNRO-2007-00022 to the NRC, dated May 23, 2007

Dear Sir or Madam:

In Reference #1, Entergy Operations, Inc. (Entergy) submitted Request for Alternative GG-ISI-002, which requests approval to implement a risk-informed inservice inspection (ISI) program at Grand Gulf Nuclear Station (GGNS). The program is to be based on ASME Code Case N-716, *Alternative Piping Classification and Examination Requirements, Section XI Division 1.*

During their review of GG-ISI-002, the NRC staff provided to Entergy, via e-mail, two sets of Requests for Additional Information (RAI). Entergy provided draft responses to the staff, which were reviewed and discussed at a meeting held on May 7, 2007. Based on those discussions, Entergy provided formal responses to the RAIs via Reference #2.

In a telephone call held on June 13, 2007, the staff posed additional questions regarding Entergy's responses to the RAIs. To address the staff's questions, Entergy is providing a revised response to Question 2 of the first set of RAIs, which is contained in the enclosure of this letter. Changes are denoted by revision bars in the margins, where applicable.

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NRR

Should you have any questions regarding this submittal, please contact Guy Davant at (601) 368-5756.

This letter contains no new commitments.

Sincerely,

JFM/GHD/ghd

Enclosure: Revised Response to Question 2 of RAI Set #1 Regarding Request for Alternative GG-ISI-002

cc:
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Mr. O. Limpias (ECH)
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ENCLOSURE

CNRO-2007-00026

REVISED RESPONSE TO QUESTION 2 OF RAI SET #1
REGARDING REQUEST FOR ALTERNATIVE GG-ISI-002

REVISED RESPONSE TO QUESTION 2 OF RAI SET #1
REGARDING REQUEST FOR ALTERNATIVE GG-ISI-002

2) The relationship between N-716's guideline that, "any piping segment whose contribution to core damage frequency (CDF) is greater than 1E-6/year is a high safety significant (HSS) segment," and the EPRI Topical guidelines for safety significant categorization is unclear. For example, a low consequence segment in the EPRI Topical methodology has a CCDP less than 1E-6, an identical numerical value but a different metric than the 1E-6/year guideline in N-716. Page 3-8 in the EPRI Topical provides an explanation that the CCDP and conditional large early release probability (CLERP) ranges were selected, "to guarantee that all pipe locations ranked in the low consequence category do not have a potential CDF impact higher than 1E-8 per year or a potential large early release frequency (LERF) impact higher than 1E-9 per year." Inspection of Table 3.1 in your submittal also indicates that there are no entries in the "CDF > 1E-6" column indicating that no segments in the Grand Gulf flooding probabilistic risk assessment (PRA) exceeded this guideline.

a) The N-716 code case Section 2(5) does not include a LERF guideline analogous to the CDF guideline, and Table 3-1 in your submittal includes a column for CDF but not for LERF. Please explain why a LERF guideline is not included as a guideline in parallel with CDF.

Response

Entergy agrees that most PRA applications with a CDF guideline include a LERF guideline, as well. Therefore, Entergy proposes to add a LERF guideline of 1E-07/year to the requirements of Section 2(a)(5) of Code Case N-716. Additionally, GGNS has reviewed low safety significant (LSS) piping [e.g., non HSS Class 2, Class 3, and non-nuclear safety (NNS) piping] against the new LERF requirement. As a result of this review, Entergy has confirmed that, in addition to having a CDF contribution of less than 1E-06/year, this piping also has a LERF contribution of less than 1E-07/year.

b) Please provide a discussion justifying the guideline value for CDF selected in Section 2(5) in N-716 (i.e., 1E-6/year).

Response

As discussed in the response to RAI 2a), Entergy has added a criterion for LERF of 1E-07/year.

From a practical perspective, the criterion used in Section 2(a)(5) of N-716 has two potential impacts. Each is discussed below.

1. Class 2 Piping

Any piping that has inspections added or removed per this code case, regardless of the value of this criterion, is required to be assessed as to its impact on risk. This risk impact analysis is conducted on an individual system basis, which *includes the cumulative effect of LSS Class 2 piping currently being inspected. The change-in-risk acceptance criteria on a system basis are defined as 1E-07/year (CDF) and 1E-08/year (LERF). These criteria are derived from Regulatory Guide (RG) 1.174 and were approved by the NRC in EPRI TR-112657. If the change-in-risk acceptance criteria are not met, additional inspections are to be defined until these criteria are met [N-716 Section 5(d)]. Therefore, regardless of the number of segments (or inspections) that fall below these criteria, unacceptable risk changes will not occur and the safety objectives of risk-informed regulation will be met.*

The change-in-risk analysis could be conducted without the benefit of these criteria [i.e., Section 2(a)(5) of N-716 and LERF per RAI 2a)] and shown to have acceptable changes in plant risk. In fact, this was demonstrated in the N-716 whitepaper where eight plants (4 BWRs, 4 PWRs) were compared to the N-716 criteria. N-716 was shown to provide for more inspections than traditional RI-ISI approaches even when the criterion of Section 2(a)(5) was not used. And, as expected, the change-in-risk acceptance criteria of 1E-07/year (CDF) and 1E-08/year (LERF) were met for these eight plants. However, implementation of this ancillary criteria [Section 2(a)(5) of N-716 and LERF per RAI 2a)] provides increased confidence that the change-in-risk acceptance criteria will be met without the need for additional inspections as would be required by Section 5(d) of N-716. Thus, any risk outliers, if they exist in Class 2 piping [(e.g., piping that exceeds the Section 2(a)(5) criterion and LERF per RAI 2a)], would require that, on a plant-specific basis, piping be added to the scope of HSS piping and subjected to inspection.

2. <u>*Class 3 / NNS Piping*</u>

   Currently, there are no Section XI NDE requirements for this piping. As such, use of this ancillary criteria [Section 2(a)(5) of N-716 and LERF per RAI 2a)], regardless of its value, can only result in a reduction in plant risk further supporting the safety objectives of risk-informed regulation. These additional inspections would be imposed on piping identified by the criterion of Section 2(a)(5) of N-716 and LERF per RAI 2 a) and cannot be used to reduce inspections in other HSS piping [see N-716 Section 4(b)].

From a more global perspective, the ancillary criteria of Section 2(a)(5) of N-716 and of LERF per RAI 2a) provide additional criteria that can only potentially increase the scope of HSS locations (i.e., will only increase the number of inspections). Although, the criteria of Sections 2(a)(1) through 2(a)(4) of N-716 were created based on the large number of risk-informed applications performed to date, Section 2(a)(5) of N-716 and LERF per RAI 2a) were added as a defense-in-depth measure to N-716 to provide a method of ensuring that any plant-specific locations that are important to safety are identified.

Adopting RI-ISI programs permits a reduction in inspection by focusing inspections on the more important locations while, at the same time, maintaining or improving public health and safety. Use of this ancillary guideline and a technically adequate, plant-specific flooding evaluation to identify relatively important locations (e.g., Class

2, 3, or NNS piping) provides additional confidence that inspections will be focused on the more important locations.

According to the guidelines in RG 1.174, plant changes (permitting the reallocation of resources) that increase risk less than 1E-06/year (CDF) / 1E-07/year (LERF) would normally be considered very small and acceptable as long as the other principles are satisfied. This is considered to be a reasonable metric for identifying significant pipe segments since the potential reduction in CDF (LERF) from inclusion of such segments in the ISI program would also be very small. Additionally, use of the guideline value of 1E-06/year for CDF (1E-07/year for LERF) taken together with the system level change-in-risk limits of 1E-07/year for CDF (1E-08/year for LERF) provides additional assurance that plant-specific application of N-716 will meet the acceptance criteria of Region III in Figures 3 and 4 of RG 1.174. Thus, assuring any increase would be small and consistent with the intent of the Commission's Safety Goal Policy Statement.

Finally, traditional RI-ISI approaches can be applied on a partial scope basis. That is, many plants have applied RI-ISI to Class 1 piping only. Thus, these plants have not witnessed the additional safety benefit of identifying and inspecting Class 2, 3, or NNS piping per criterion Section 2(a)(5) of N-716 and LERF per RAI 2a).

c) Please provide a list of the piping segments that were compared to the > 1E-6/year criterion along with the CDF and LERF estimates, the pipe failure frequency, and the CCDP and conditional large early release probability for each segment.

Response

The scope of piping reviewed against this criterion consisted of Class 2 piping not classified as HSS as well as BER, Class 3, and NNS piping. The GGNS internal flooding study was used to conduct this comparison. The GGNS internal flooding study was performed in a step-by-step manner with an initial qualitative screening to identify the significant flood events and a quantitative analysis to determine the contribution to core damage for the most significant flood scenarios.

As opposed to a segment-by-segment evaluation, the GGNS internal flooding study was performed by defining flood zones, identification of their contents (e.g., important equipment), identification of potential flood sources, identification of flood propagation pathways, a qualitative screening analysis and a quantitative analysis of potentially important flood scenarios.

With respect to flood frequency, only the largest flood initiator per system in each flood zone was considered if the frequency and consequence of the larger flood initiator were approximately of the same magnitude as those of the smaller one. If the frequency of the smaller flood initiator was higher and its consequences similar to that of the larger initiator, the smaller flood initiator was considered the primary flood source for that particular system. For screening purposes, this is conservative from an internal flooding study perspective. It is also conservative from an N-716 perspective because some of these flooding sources (e.g., tanks) may not be within the N-716 scope (e.g., piping).

An example of the process is described as follows:

> *A flooding scenario in flood zone "A" revealed that a Flow Control Valve (FCV) in support of system "Z" would become submerged. Using the component failure matrix developed for the internal flooding study, this FCV is identified to fail when submerged. The fault tree for system "Z" is reviewed and the FCV failure is discovered to lead to the failure of the in-line pump, which results in system "Z" being unable to deliver flow to its loads. Therefore, the entire system "Z" fails due to submergence of the FCV. Subsequent to the analysis of the failure of system "Z", the dependency matrices were used to determine which other systems would fail [e.g., Instrument Air system failure would lead to failure of several mitigating systems, including Control Rod Drive (CRD), Containment Venting, Feedwater, Condensate, Component Cooling Water (CCW), Turbine Building Cooling Water (TBCW), and Plant Service Water (PSW)].*
>
> *A listing of failed mitigating systems for each flooding scenario, as well as available mitigative systems, was compiled for use in the qualitative analysis.*

Flood initiation frequency was on the order of 1E-3 to 1E-4 / year per zone. The failure of a single equipment train is on the order of 1E-2, except for some equipment [(e.g., Reactor Core Isolation Cooling (RCIC)] which can be higher (e.g., 1E-1). Therefore, the approximate likelihood of a flood plus two unrelated, random system failures is 1E-7 to 1E-8 / year. Due to the approximate nature of these estimated values, it is possible that a flood plus two random failures could occur with some significant probability. Thus, any flood scenario for which two or less random failures could produce core damage was analyzed in more detail. Similarly, any flood scenario for which three or more random system failures could produce core damage was screened out. Typically, this screening was done on a zone-by-zone basis. Thus, individual segments within the zone would have a likelihood of core damage less than that for the entire zone.

Based on the above, two flooding scenarios required detailed quantification. These scenarios involved the PSW system (CDF = 1.99E-7) and the standby service water system (CDF = 2.26E-8), which, after detailed quantitative assessment, fall below the criterion of Section 2(a)(5) of N-716.

d) Please provide any observations made during any independent reviews of the Grand Gulf flooding PRA or observations from the internal events review that are also applicable to the flooding analysis. Please describe how these observations have been resolved such that there is confidence that segments that have a CDF greater than the guideline value have been identified.

Response

As indicated in the initial submittal, the industry peer review of the GGNS PRA was conducted in August 1997. The facts and observations (F&O) from this review were characterized with regard to level of significance and given scores of A, B, C, or D. An F&O with a level of significance of "A" is one that is extremely important and necessary to address to assure the technical adequacy of the PRA or the quality of *the PRA. These should be addressed promptly. An F&O with a level of significance of "B" is one that is important and necessary to address, but may be deferred until the next PRA update. "C" F&Os are of marginal importance, but are considered desirable to maintain maximum flexibility in PRA Applications and consistency in the industry. "D" F&Os are editorial or minor technical items left to the discretion of the utility. As such, the important F&Os to PRA technical adequacy and quality are those categorized as "A" or "B." Within the "A" & "B" F&Os, only two "B" F&Os are on the internal flooding analysis.*

The first "B" F&O stated that the dependency table in the internal flooding analysis did not list the Instrument Air system as a support system. No changes were necessary to address this comment since Instrument Air was clearly listed as a support system in various locations in the documentation, including the mitigating systems-versus-support systems dependency table and the support systems-versus-support systems table.

The remaining "B" F&O documented issues associated with a single flooding sequence. The first issue questioned whether there was a thermal hydraulic calculation which supports the use of a single CRD pump for success following a manual emergency depressurization. This issue was addressed by developing a calculation for CRD success criteria. As a result of the calculation, CRD is now credited only after another system (such as RCIC or HPCS) has provided core injection for approximately 5 hours and two CRD pumps operate. This modeling is incorporated into the modeling used to develop CCDPs for the N-716 analysis. The second issue pointed out that the text description of a sequence indicated that it resulted in core damage while the event tree indicated that the core was OK. The text description was in error and, since the event tree was the input into the development of the overall model fault tree, there was no related impact on the PRA results. The remaining issue stated that containment venting is not asked in the sequence; therefore, containment heat removal capability is unknown. That was basically a true statement as it was not necessary to vent the containment in order to determine the outcome of this sequence. Containment failure does not directly lead to failure of operating injection pumps since the most likely failure location is high in the containment and any steam released into the Auxiliary Building is not expected to impact these pumps which are low in the Auxiliary Building.