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GNRO-2012/00157

December 19, 2012

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

SUBJECT: Response to Clarification Questions on Reanalysis of Severe Accident Mitigation Alternatives (SAMA) Letter dated November 19, 2012
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERENCE: NRC Letter, "Reanalysis of Severe Accident Mitigation Alternatives," dated November 19, 2012 (GNRI-2012/00144)

Dear Sir or Madam:

Entergy Operations, Inc. is providing, in the Attachment, responses to additional clarification questions posed by the NRC staff on the SAMA reanalysis.

This letter contains no new commitments. If you have any questions or require additional information, please contact Jeffery A. Seiter at 601-437-2344.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 19th day of December, 2012.

Sincerely,

KJM/jas

Attachment: Responses to Clarification Questions

cc: (see next page)

A001
NRR

cc: with Attachment

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Attachment to

GNRO-2012/00157

Responses to Clarification Questions

The format for the severe accident mitigation alternative clarification question responses below is as follows. The clarification question is listed in its entirety as received from the Nuclear Regulatory Commission (NRC). This is followed by the Grand Gulf Nuclear Station (GGNS) response to the individual question with acronyms defined when used in the GGNS response.

1. The first paragraph of page 2 of Enclosure 1 to GNRO-2012/00144 describes the source of the new SAMA reference CDF (2.93E-06/rx-yr) as calculated using the level 2 rule files. It is stated to be slightly different from the value calculated from the Level 1 analysis (2.91E-06/rx-yr) due to the use of the minimal cutset upper bound (MCUB) quantification technique. It is also noted that the accident class frequencies have changed in Table E.1-7. Since accident class frequencies are defined by the Level 1 analysis, these changes would not be expected from the Level 2 model changes described in the recent submittal.

   Briefly, explain the difference in the two CDF values and in the accident class frequencies and how these are impacted by the level 2 rule file changes described in the resubmittal.

   Response to Clarification Question 1

   Both the level 1 and new severe accident mitigation alternative (SAMA) reference core damage frequency (CDF) values were calculated by quantifying each of the level 1 sequence endstates, then merging the cutset files and subsuming. The difference between the two values is that the level 1 value of 2.91E-06/rx-yr was calculated using the level 1 rule file to apply recovery events and the new SAMA reference CDF of 2.93E-06/rx-yr was calculated using the level 2 rule file to apply recovery events.

   The accident class frequencies in Table E.1-7 changed due to use of the level 2 rule file. The changes to the recovery rule file impact the level 1 values being passed to the level 2 portion of the model. The revised Table E.1-7 reflects this change, which is appropriate since it reflects the actual values in the model used for the SAMA analyses.

   Enclosure 1 to GNRO-2012/00144 described three changes made to the level 2 rule file. The change in NRS-DHRLT, "Failure to Initiate Suppression Pool Cooling and Failure to Initiate Containment Spray" from 1E-7 to 1E-6 increased the CDF and changed the accident class frequencies in Table E.1-7. The changes to the level 2 loss of offsite power recovery rules did not contribute to the change in CDF or to the changes in the accident class frequencies in Table E.1-7.

   [GNRO-2012/00144 had a typo in the event name; NRS-DH<u>LR</u>T should be NRS-DH<u>RL</u>T.]

2. Explain why the 2010 EPU LERF value of 1.48E-7/ry on Page E.1-68 of the ER differs from the LERF value of 1.04E-7/ry on Page E.1-24.

   Response to Clarification Question 2

   The 2010 EPU LERF (extended power uprate, large early release frequency) value of 1.48E-7/rx-yr comes from the R3 EPU LERF model. The LERF value of 1.04E-7/rx-yr is the H/E (high, early) release mode frequency from the full level 2 model created for use in the SAMA analysis and described in Section E.1.2 of the environmental report (ER).

3. The first bullet on page 2 of Enclosure 1 to GNRO-2012/00144 describes analysis case 5 used for evaluating SAMAs 6 and 17. The cost of these SAMAs is stated to be $656,000 from the Susquehanna SAMA submittal. This cost for Susquehanna is for both units of the two unit site. Note also, the updated Table E.2-2 indicates that the cost is from the Cooper SAMA submittal. Cooper gives $656K and $217K for SAMAs 6 and 17 respectively with the former taken from Susquehanna and the latter from Brunswick. Provide additional information that supports the use of a cost of $656K for a single unit in the GGNS' evaluation of SAMAs 6 and 17.

Response to Clarification Question 3

A detailed cost estimate was not necessary to conclude that modifications to improve the 4.16-kilovolt (kV) bus cross-tie capability or to provide alternate feeds to essential loads would cost at least $656,000. Discussion of the engineering judgment used in applying this cost estimate to each modification follows.

<u>SAMA 6 - Improve 4.16-kV bus cross-tie ability</u>

As indicated in Attachment 2 to GNRO-2012/00072 (Phase I Candidates SAMA Analysis), this SAMA was retained to increase the reliability of the cross-tie from division 3 to either division 1 or division 2 since each of the emergency safety feature (ESF) buses already has the capability of sharing power from any of the three ESF transformers with another ESF bus.

The division 3 diesel generator (DG)13 may be used to feed division 1 bus 15AA or division 2 bus 16AB during a station blackout (SBO), but this requires back-feed through an ESF transformer as there is no direct interconnection between the ESF buses. Therefore, to improve the cross-tie ability would require installation of a direct cross-tie from DG13 to bus 15AA or bus 16AB. Modifications would also be required to the load shedding and sequencing system to prevent tripping DG13 when the bus is tied to it. Finally, provisions would have to be made to facilitate powering devices left unpowered when feeding an ESF bus from division 3. Specifically, if bus 16AB is energized from division 3 there will be no power to the division 1 battery chargers. Thus, reactor core isolation cooling (RCIC) will continue to drain battery power, will stop when the battery discharges, and will have to be manually restarted without control power. Also, if bus 15AA is energized from division 3, plant air compressor 'A' cannot be restarted to restore instrument air.

Thus, the modification would require extensive changes to the control scheme for the busses as well as several calculations, procedure changes, drawing changes, and licensing basis documentation changes. These documentation changes were judged to cost more than $400,000. Also, the modification hardware, installation, and testing were judged to cost more than $256,000. Thus, implementation of SAMA 6 would cost at least $656,000.

<u>SAMA 17 - Provide alternate feeds to essential loads directly from an alternate emergency bus</u>

Prior to implementing this modification, extensive engineering work would be necessary to determine what alternate feeds should be added. (To provide the benefit calculated in analysis case 5, all loads on an ESF bus would need to have alternate power feeds.) The desired alternate feeds would have to be analyzed to ensure train separation is maintained, to ensure electrical breaker coordination, and to determine necessary changes to the load shedding and sequencing system. This modification would also require extensive changes to the control scheme for the buses as well as several calculations, procedure changes, drawing changes, and licensing basis document changes. These documentation changes were judged to cost more than $400,000. Also, the modification hardware, installation, and testing were judged to cost more than $256,000. Thus, implementation of SAMA 17 would cost at least $656,000.

4. The new plant specific cost estimates incorporated into the revised cost-benefit analysis for a number of SAMAs are considerably greater than those previously given and appear large compared to that implied by the SAMA description and/or that given for similar SAMAs at other plants. Provide a brief description of what is included in the new cost estimates for SAMAs 1, 9, 11, 14 and 63 or other information to justify these cost estimates.

Response to Clarification Question 4

The detailed SAMA implementation cost estimates followed Entergy's standard process for development of project estimates. The process is applied to establish conceptual (+/- 25% to 50% accuracy), preliminary (+/- 15% to 30% accuracy), and definitive (+/- 10% to 20% accuracy) estimates during the study, design, and implementation phases of a design project.

The SAMA cost estimates capture all anticipated expenses by identifying all parts of the organization that must support the proposed SAMA modification from the conceptual perspective. Typical expenses associated with project cost estimating include calculations, drawing updates, specification updates, bid evaluations, contract issuance, design package preparation, walkdowns, planning and scheduling, estimating, procurement, configuration management, health physics, quality assurance, quality control, training, simulator, information technology, design basis update, construction, multi-discipline and independent review of design concepts and calculations, 50.59 review, design basis document update, cost control, contingency, security, procedures, post modification testing, and project management and close-out. In addition, the project cost estimates include corporate indirect charges.

In summary, the cost estimates for the subject SAMAs followed Entergy's standard process for development of project estimates. Therefore, these cost estimates are reasonable conceptual level estimates. Specific considerations for each of the five SAMAs follow.

<u>SAMA 1, Provide Additional DC Battery Capacity</u>

The conceptual implementation cost estimate of $2,130,887 for SAMA 1 considered the costs associated with purchase and installation of a new battery, two new battery chargers, a distribution center and a distribution panel as well as fabrication and installation of new battery racks.

<u>SAMA 9, Use Fire Water System as Backup Source for Diesel Cooling</u>

The DG cooling water system is a closed system which rejects heat to the standby service water system. The SAMA improvement would modify the DG cooling water system to allow it to reject heat to the fire water system. The conceptual implementation cost estimate of $1,344,116 for SAMA 9 considered the costs associated with modifying the diesel building fire water system and DG cooling water system piping, purchasing and installing fire water and standby service water air operated isolation valves, and purchasing and installing conduit, cable, controllers and a control box.

<u>SAMA 11, Portable Generator to Supply Power to Battery Chargers</u>

The conceptual implementation cost estimate of $1,278,211 for SAMA 11 considered the costs associated with purchasing a portable generator and fuel transfer system as well as installing transfer switches, conduit and cables. Rather than include heating, ventilation, and air conditioning (HVAC) modifications for the generator exhaust, the estimate assumed that, when needed, the generator would be moved to a location outside existing plant buildings. A local control panel at the designated outdoor location would allow alignment to the battery chargers via manual switches.

<u>SAMA 14, Provide a portable EDG fuel oil transfer pump</u>

The conceptual implementation cost estimate of $1,477,188 for SAMA 14 considered the costs associated with purchasing a portable fuel tanker with transfer pump, purchasing and installing fuel oil connection lines at the main storage tank and at each fuel oil day tank, as well as purchasing and installing isolation valves and remote level indicators.

<u>SAMA 63, Add a redundant RCIC lube oil cooling path</u>

The RCIC turbine lube oil cooler is cooled by water from the discharge of the RCIC pump. The modification was assumed to provide connections to cool RCIC lube oil using the firewater system. The conceptual implementation cost estimate of $1,803,463 for SAMA 63 considered the costs associated with purchasing and installing pipe tees and motor-operated valves (MOVs) on RCIC lube oil cooling water and firewater piping, purchasing and installing pipe hangers, MOV supports, conduit, cable and terminal boxes, and modifying a control room panel.

5. Does GGNS have a portable generator for satisfying B.5.b requirements that could be used for SAMAs 11 and 12? If so, consider its availability in the cost estimates for these and other SAMAs for which it might be used.

Response to Clarification Question 5

GGNS does not have a portable generator that could be used for SAMAs 11 and 12. GGNS has a portable generator used for satisfying B.5.b requirements – specifically, for powering the hydrogen igniters. However, since the generator is being used to supply one division of hydrogen igniters post-accident, it cannot also be used to supply the battery chargers or other panels. Therefore, this generator is not considered in the cost estimate and SAMAs 11 and 12 are not cost-beneficial.

6. Table E.2-3 in Attachment 1 to GNRO-2012/00144 presents the sensitivity of calculated benefits to a longer time period for remaining plant life (Sensitivity Case 1) and lower discount rate (Sensitivity Case 2). Benefit increases and sensitivities due to a longer time period for remaining plant life exhibited similar trends in the original and reanalysis results. Compared to the original analysis results, benefit increases and sensitivities due to a lower discount rate were much larger in the reanalysis results. Explain the unexpectedly large increase in sensitivity to the discount rate.

Response to Clarification Question 6

The revised sensitivity case 2 (lower discount rate) was inadvertently calculated using both the longer time period for remaining plant life (33 years) and the lower discount rate (3%), causing the large increase in the sensitivity results. Nevertheless, additional cost-beneficial SAMAs were not identified. Had sensitivity case 2 been performed with 20 years for remaining plant life and a 3% discount rate, the resulting benefits would have been smaller. Therefore, the SAMA analysis has identified the appropriate potentially cost-beneficial SAMAs.