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GNRO-2016/00040

September 7, 2016

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

SUBJECT: Response to Request for Additional Information (RAI) on Severe Accident Mitigation Alternatives (SAMA) for Grand Gulf Nuclear Station License Renewal Environmental Review  
Grand Gulf Nuclear Station, Unit 1  
Docket No. 50-416  
License No. NPF-29

REFERENCES: 1. Entergy Letter GNRO-2012/00144, "Reanalysis of Severe Accident Mitigation Alternatives," date November 19, 2012  
2. U.S. NRC Letter, "Request for Additional Information on Severe Accident Mitigation Alternatives for the Review of the Grand Gulf Nuclear Station, Unit 1, License Renewal Application Environmental Review", dated July 12, 2016 (ML 16181A112)

Dear Sir or Madam:

Entergy Operations, Inc. is providing, in the Attachment, response to the Request for Additional Information (RAI) on Severe Accident Mitigation Alternatives (SAMA).

This letter contains no new commitments.

If you have any questions or require additional information, please contact James Nadeau at 601-437-2103.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 7th day of September, 2016.

Sincerely,

A handwritten signature in black ink, appearing to be "VF", written over a horizontal line.

VF/ras

Attachment: Response to Request for Additional Information on Severe Accident Mitigation  
Alternatives for Grand Gulf Nuclear Station License Renewal Environmental Report

cc: with Attachment

U.S. Nuclear Regulatory Commission  
ATTN: Mr. David Drucker, NRR/DLR  
Sr. Project Manager  
Environmental Review and Projects Branch  
Division of License Renewal  
Office of Nuclear Reactor Regulation  
Mail Stop OWFN-11-F1  
Washington, DC 20555

cc: without Attachment

U.S. Nuclear Regulatory Commission  
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U.S. Nuclear Regulatory Commission  
1600 East Lamar Boulevard  
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Mail Stop OWFN/8 G14  
11555 Rockville Pike  
Rockville, MD 20852-2378

NRC Senior Resident Inspector  
Grand Gulf Nuclear Station  
Port Gibson, MS 39150

Attachment to

GNRO-2016/00040

Response to Request for Additional Information on Severe Accident Mitigation Alternatives for  
Grand Gulf Nuclear Station License Renewal Environmental Report

**Response to Request for Additional Information on  
Severe Accident Mitigation Alternatives  
for Grand Gulf Nuclear Station  
License Renewal Environmental Report**

**Request for Additional Information:**

On May 4, 2016, the Commission issued a decision (CLI-16-07) in the Indian Point license renewal proceeding, in which it directed the NRC staff to supplement the Indian Point Severe Accident Mitigation Alternatives (SAMA) analysis with sensitivity analyses. Specifically, the Commission held that documentation was lacking for two inputs (TIMDEC and CDNFRM) used in the MACCS computer analyses, and that uncertainties in those input values could potentially affect the SAMA analysis cost-benefit conclusions. The Commission therefore directed the NRC staff to perform additional sensitivity analyses.

The two inputs (TIMDEC and CDNFRM) are commonly used in the SAMA analyses performed for license renewal applications (LRAs). These two input values were generally based on the values provided in NUREG 1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants" and NUREG/CR-3673, "Economic Risks of Nuclear Power Reactor Accidents." The TIMDEC input value defines the time required for completing decontamination to a specified degree. The CDNFRM input parameter defines the cost (on a per person basis) of decontaminating non-farmland by a specified decontamination factor. The CDNFRM values used in NUREG-1150 (\$3,000/person for decontamination factor of 3 and \$8,000/person for decontamination factor of 15) stem from decontamination cost estimates provided in NUREG/CR-3673, the same 1984 economic risk study referenced in support of the decontamination time inputs. These decontamination cost inputs are commonly escalated to account for inflation.

The NRC staff believes the Commission's decision in CLI-16-07 may be applicable to the SAMA analysis performed for Grand Gulf Nuclear Station, inasmuch as that analysis may have also relied upon the NUREG-1150 values for TIMDEC and CDNFRM. We therefore request that Entergy Operations, Inc. (Entergy) either justify why CLI-16-07 does not apply to the SAMA analysis performed for Grand Gulf Nuclear Station or supplement the SAMA analysis with sensitivity analyses for the CDNFRM and TIMDEC values.

Entergy is requested to review the input values specified in CLI-16-07 for the Indian Point LRA, and (1) to apply the maximum values specified by the Commission (one year (365 days) for TIMDEC and \$100,000 for the CDNFRM values for the decontamination factor of 15) or, in the alternative, (2) to explain, with sufficient justification, its rationale for choosing any other value(s) for its sensitivity analyses. In any event, Entergy should execute sensitivity analyses for the release categories modeled that exceed  $10^{15}$  Becquerels of Cs-137 released. Entergy is requested to evaluate how these sensitivity analyses may affect its identification of potentially cost-beneficial SAMAs. Finally, upon completing its sensitivity analysis, Entergy is requested to submit the spreadsheet (or equivalent table if another method is used) that conveys the population dose and off-site economic cost for each release category and integrates the results into a Population Dose Risk and an Offsite Economic Cost Risk for Grand Gulf Nuclear Station.

## **Entergy Response**

Entergy has chosen to use response option “1) to apply the maximum values specified by the Commission ... for the release categories modeled that exceed  $10^{15}$  Becquerels of Cs-137 released.” Thus, a MACCS2 sensitivity case was developed with the following changes (as compared to the GGNS MACCS2 base case documented in the Grand Gulf Operating License Renewal Stage Applicant’s Environmental Report (“Environment Report”) as updated by the Grand Gulf Reanalysis of Severe Accident Mitigation Alternatives (“SAMA Reanalysis”) dated November 19, 2012 (ML12325A174):

- TIMDEC was escalated to one year (365 days) for decontamination factor (DF) =15
- CDNFRM was escalated to \$100,000/person for DF=15
- These changes were applied to all release categories (those with total releases exceeding  $10^{15}$  Becquerels of Cs-137 and those with total releases less than  $10^{15}$  Becquerels of Cs-137).

Both the conditional and frequency-weighted MACCS2 results of this sensitivity case for offsite dose and economic cost are presented in Table 1 for each release category, as the RAI requests. The frequencies used to weight the results are those from the SAMA Reanalysis (Table E.1-13).

For the specified TIMDEC and CDNFRM input changes, the MACCS2 Offsite Economic Cost Risk (OECR) increased approximately 100% and the Population Dose Risk (PDR) decreased approximately 14% as compared to the MACCS2 base case OECR of \$1.51E+3/yr and PDR of 0.61 person-rem/yr as presented in the SAMA Reanalysis Table E.1-13.

The PDR decrease is attributed to the interplay between the relatively low land values in the region and the increased decontamination cost inputs. With the increased decontamination costs, more land is condemned rather than decontaminated because condemnation is more cost effective. For example, for the M/E release category which is the most risk significant, the population associated with condemned land increased from approximately 120 individuals (base case) to 14,300 individuals (sensitivity case). Individuals associated with condemned land are permanently relocated following the early accident phase and receive no further dose. Individuals who are resettled following decontamination activities are modeled to receive low levels of dose for the ensuing years based on the land habitability criteria following decontamination. Therefore, condemning significantly more land results in a modest population dose decrease.

The increase in the OECR (and the decrease in the PDR) for this sensitivity case is bounded by the SAMA analysis 95<sup>th</sup> percentile uncertainty factor of 3.0, which was included as part of the SAMA candidate cost-benefit evaluation documented in Section E.2 of the Environmental Report, as updated by the SAMA Reanalysis. Therefore, no new SAMA candidates are identified as potentially cost-beneficial based on this new TIMDEC and CDNFRM sensitivity case. There are no changes to the conclusions of the SAMA analysis based on the TIMDEC and CDNFRM sensitivity case.

Table 1  
 MACCS2 TIMDEC and CDNFRM Sensitivity Results

Release Category	Frequency (per yr)	Population Dose (p-rem)	Population Dose Risk (p-rem/yr)	PDR % of Total	Offsite Economic Cost (\$)	Offsite Economic Cost Risk (\$/yr)	OECR % of Total
H/E	1.04E-07	4.87E+05	5.06E-02	9.6%	3.51E+09	3.65E+02	12%
H/I	1.21E-08	4.31E+05	5.22E-03	1.0%	2.83E+09	3.42E+01	1.1%
H/L	9.21E-08	3.66E+05	3.37E-02	6.4%	1.94E+09	1.79E+02	5.9%
M/E	3.70E-07	4.03E+05	1.49E-01	28%	2.60E+09	9.62E+02	32%
M/I	1.81E-07	5.18E+05	9.38E-02	18%	4.02E+09	7.28E+02	24%
M/L	3.03E-07	3.38E+05	1.02E-01	19%	2.08E+09	6.30E+02	21%
L/E	4.05E-09	9.84E+04	3.99E-04	0.08%	8.42E+07	3.41E-01	0.01%
L/I	3.55E-08	3.05E+05	1.08E-02	2.1%	1.15E+09	4.08E+01	1.3%
L/L	4.44E-07	1.73E+05	7.68E-02	15%	1.92E+08	8.52E+01	2.8%
LL/E	2.19E-09	3.62E+02	7.93E-07	<0.001%	4.63E+05	1.01E-03	<0.001%
LL/I	2.12E-09	1.80E+02	3.82E-07	<0.001%	4.59E+05	9.73E-04	<0.001%
LL/L	7.05E-09	2.78E+05	1.96E-03	0.4%	7.02E+08	4.95E+00	0.2%
NCF	1.37E-06	3.62E+02	4.96E-04	0.09%	4.63E+05	6.34E-01	0.02%
Total	2.93E-06	--	5.25E-01	100%	--	3.03E+03	100%