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G3NO-2008-00007

October 9, 2008

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

DOCKET NO.: 52-024

SUBJECT: Responses to NRC Requests for Additional Information, Letter No. 03 (GG3 COLA)

REFERENCE: NRC Letter to Entergy Nuclear, Request for Additional Information Letter No. 03 Related to SRP Section 12.03-12.04 for the Grand Gulf Combined License Application, dated September 12, 2008 (ADAMS Accession No. ML082560372)

Dear Sir or Madam:

On September 12, 2008, in the referenced letter, the NRC requested additional information to support the review of certain portions of the Grand Gulf Unit 3 Combined License Application (COLA). The responses to the following Requests for Additional Information (RAIs) are provided as Attachments 1 through 3 to this letter:

- RAI No. 12.03-12.04-1, Construction Worker Dose Estimates
- RAI No. 12.03-12.04-2, Construction Worker Dose Estimates
- RAI No. 12.03-12.04-3, Construction Worker Dose Estimates

This information will be incorporated into a future submission of the Grand Gulf Unit 3 COLA, as described in the attachments.

Should you have any questions, please contact me or Mr. Tom Williamson of my staff. Mr. Williamson may be reached as follows:

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D088
NRO

This letter contains commitments as identified in Attachment 4.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 9, 2008.

Sincerely,

WKH/ghd

Attachments:
1. Response to NRC RAI Letter No. 3, RAI Question No. 12.03-12.04-1
2. Response to NRC RAI Letter No. 3, RAI Question No. 12.03-12.04-2
3. Response to NRC RAI Letter No. 3, RAI Question No. 12.03-12.04-3
4. Regulatory Commitments

cc (email, unless otherwise specified):
Mr. T. A. Burke (ECH)
Mr. S. P. Frantz (Morgan, Lewis & Bockius)
Mr. B. R. Johnson (GE-Hitachi)
Ms. M. Kray (NuStart)
Mr. P. D. Hinnenkamp (ECH)

NRC Project Manager – GGNS COLA
NRC Director – Division of Construction Projects (Region II)
NRC Regional Administrator - Region IV
NRC Resident Inspectors' Office - GGNS

ATTACHMENT 1

G3NO-2008-00007

RESPONSE TO NRC RAI LETTER NO. 3

RAI QUESTION NO. 12.03-12.04-1

RAI QUESTION NO. 12.03-12.04-1

NRC RAI 12.03-12.04-1

FSAR Appendix 12CC provides an updated analysis of annual construction worker dose. A review of this analysis identifies potential underestimation of construction worker dose from direct radiation from the Nitrogen-16 source from the main turbine building and direct radiation from the Unit 1 independent spent fuel storage installation (ISFSI). The gamma doses measured at the protected area fence during recent years (2005-2007) have increased above the levels found in previous years (2000-2002). These doses are used for the construction worker dose calculation. In addition, the calculation of direct radiation dose to the construction workers from the Unit 1 ISFSI appears not to have considered doses associated with the gamma ray component of the radiation emanating from the individual spent fuel dry casks stored at the ISFSI. Also, the dose calculations appear to have used an incorrect method to estimate the direct dose at 100 meters from the ISFSI confines.

Accordingly:

> Provide an updated annual and maximum hourly direct dose analysis in Appendix 12CC. Provide sufficient information for the staff to evaluate the bases and assumptions used in the analysis and for conducting an independent confirmation of compliance with NRC regulations. Sufficient information includes, but is not limited to, maps identifying the locations of, and distances between, the ISFSI (and other radiation sources) and construction worker sites, radiation source strengths, and any calculational measurements and isodose curves used in the analysis.

Since this information is related to Section 4.5 of the Environmental Report, this RAI is related to Environmental RAI 4.

Entergy Response

The Grand Gulf Unit 3 Construction Worker Dose analysis has been updated to address increased gamma doses at the Unit 1 protected area fence and increased gaseous radiological effluent from Unit 1 measured in recent years. In addition, the methodology used to estimate the direct radiation dose from the Unit 1 ISFSI has been corrected and updated. The updated annual and maximum hourly direct dose analysis and results, 81.1 mrem and <2 mrem/hr, respectively, are provided in the proposed revision to FSAR Appendix 12CC included with this attachment. Necessary information is provided in FSAR Appendix 12CC to evaluate the bases and assumptions used in the analysis and for conducting an independent confirmation of compliance with NRC regulations with the exception of a figure showing the ISFSI location relative to principle construction areas, and isodose curves used in the analysis of the ISFSI. A figure showing the ISFSI location relative to the construction areas (Figure 1), and the far-field isodose curves used in the Unit 1 dose analysis of the ISFSI (Figure 2) are provided below.

The Grand Gulf Unit 3 estimated construction worker dose has been determined based on the most current radiological monitoring data available for Grand Gulf Unit 1 (i.e., 2005 – 2007) and applies this data in a conservative manner. This data captures the effects of recent increases in hydrogen injection associated with high hydrogen water chemistry and increased gaseous effluent releases associated with fuel failures. In addition, this calculation assumes

that the current GGNS Unit 1 ISFSI is fully loaded at the time of construction of Unit 3. Consistent with the requirements of 10 CFR 20.1302, the Grand Gulf Unit 1 Radiation Protection Program and Offsite Dose Calculation Manual demonstrate compliance with 10 CFR Part 20 dose limits for individual members of the public by requiring surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas. Restrictions on access to areas that might exceed 10 CFR 20 dose limits are implemented, as required.

Figure 1. GGNS Unit 1 Site Plan Showing Protected Area Fence TLD Locations, ISFSI, and Unit 3 Construction Areas

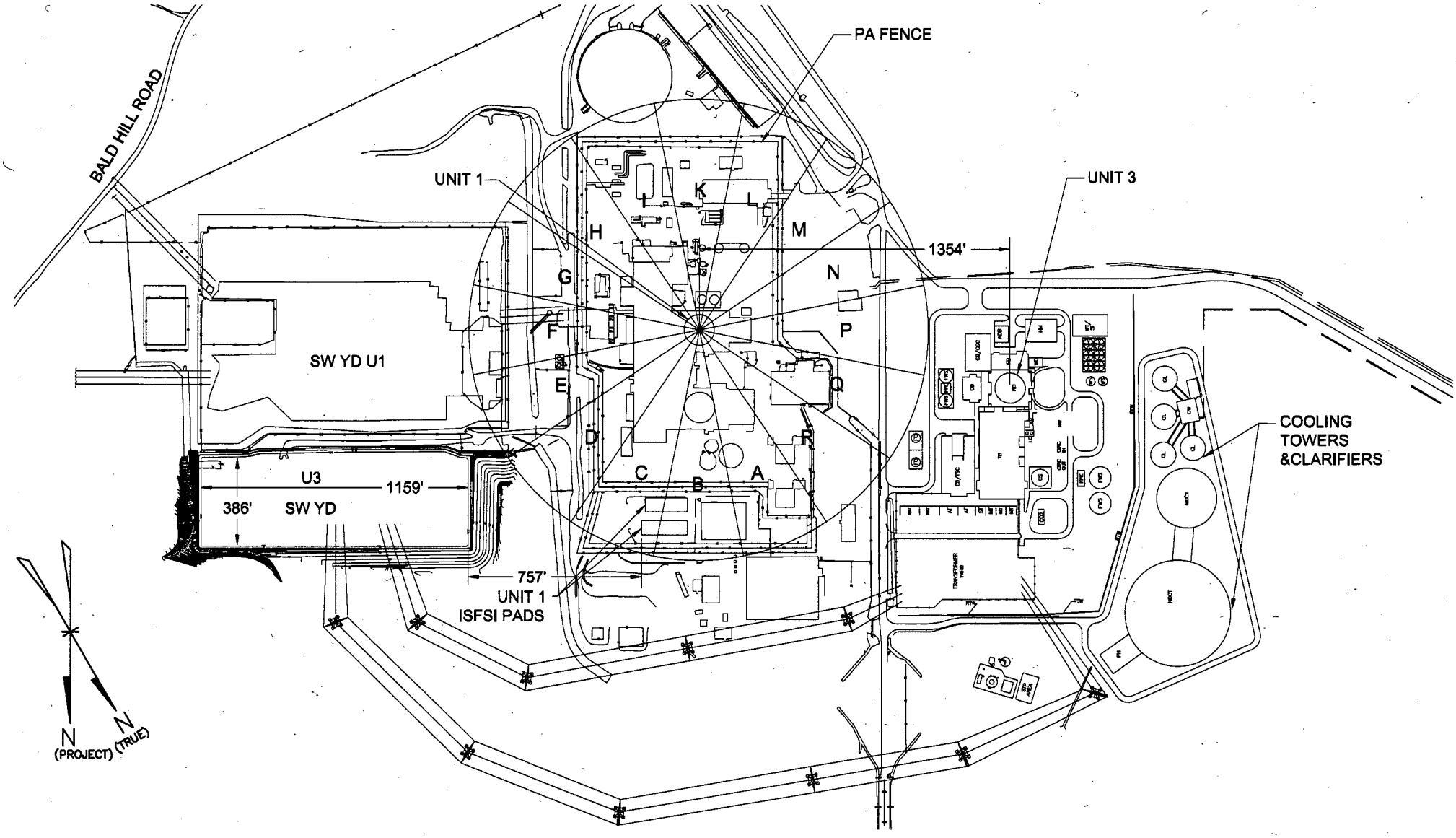
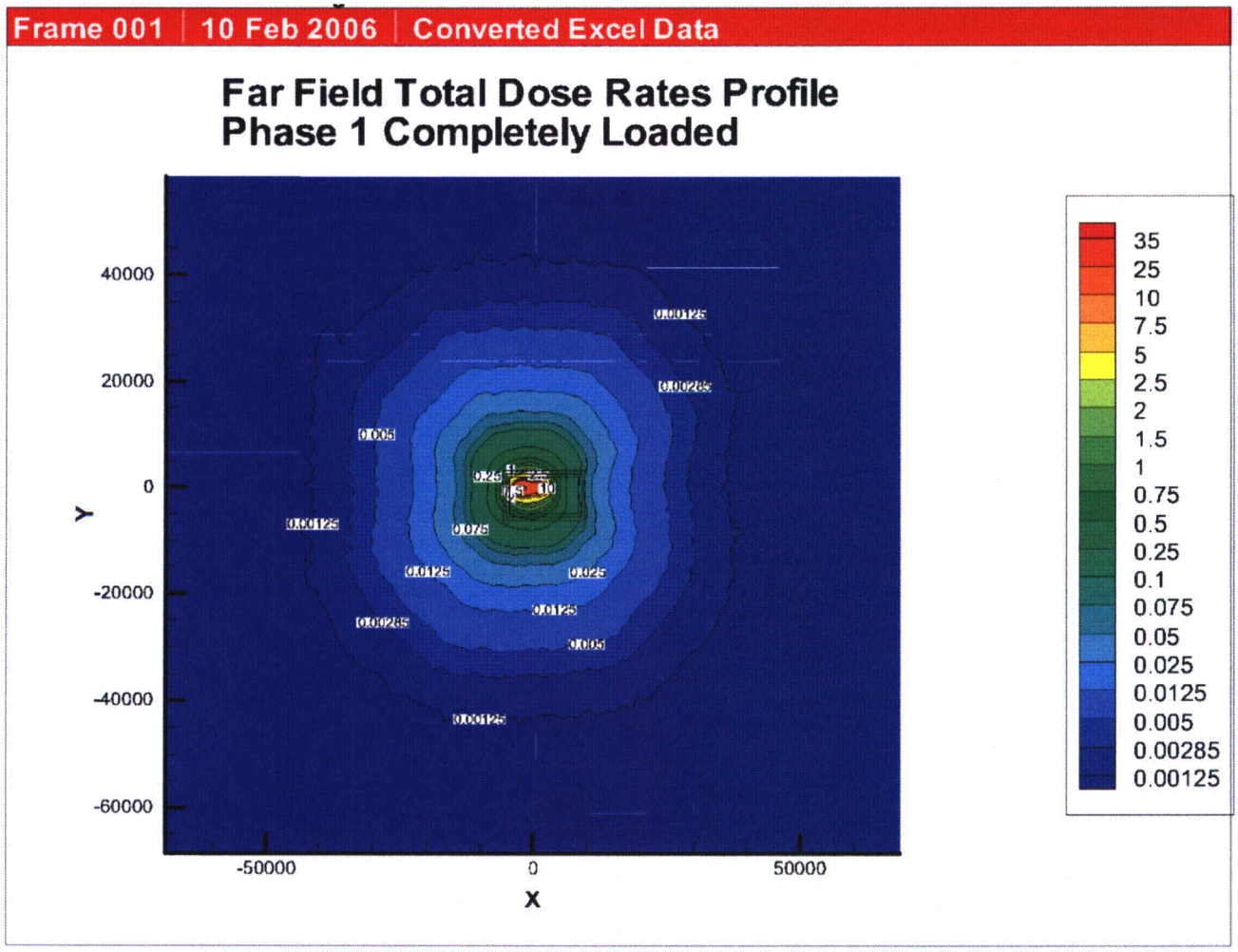


Figure 2
GGNS MCNP Model Far Field Dose Rates



Note: 1. Plant North corresponds to the Y axis shown.
2. Distance units given in centimeters. Dose units given in mrem/hr.

Proposed COLA Revision

FSAR Appendix 12CC and associated tables will be revised as indicated in the draft markup included with this attachment.

As indicated in Entergy's response to Environmental Report RAI Item #1 (Entergy letter to NRC, G3NO-2008-00001, dated October 6, 2008), Environmental Report Section 4.5 will be revised in a future COLA submittal to address the revision to the estimated construction worker dose as discussed above, and will be consistent with the revision to FSAR Appendix 12CC included with this RAI response.

Markup of Grand Gulf COLA

The following markup represents Entergy's good faith effort to show how the COLA will be revised in a future COLA submittal in response to the subject RAI. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be somewhat different than as presented herein.

GGNS SUP 12.4-1 APPENDIX 12CC DOSES TO CONSTRUCTION WORKERS HISTORICAL INFORMATION

Radiological dose estimates to construction workers at Unit 3 construction locations on the Grand Gulf site resulting from the operation of Unit 1, a boiling-water reactor nuclear plant, are provided herein.

12CC.1 SITE LAYOUT

Figure 1.1-201 provides the layout and arrangement of the Unit 3 plant structures. Figure 2.4.1-201, Sheet ~~8~~2, provides the layout of the site, including Unit 1 structures, and their location with respect to Unit 3 structures, and Figure 2.4.1-202 shows the relative location of the liquid effluent discharge to the location of the Unit 3 intake embayment.

12CC.2 RADIATION SOURCES

Construction workers on the Unit 3 site could be exposed to direct radiation, and to liquid and to gaseous radioactive effluents emanating from the routine operation of Unit 1. Radiation dose to construction workers will be due mostly to skyshine from the nitrogen-16 (N-16) source present in the operating Unit 1 main turbine steam cycle. However, exposure from the Unit 1 condensate water storage tank (CST), the dry fuel storage facility, and from airborne effluents from Unit 1 are also considered.

The N-16 activity present in the reactor steam in the main steam lines, turbines, and moisture separators provides an air-scattered radiation dose contribution to locations outside the Unit 1 structures as a result of the high energy gamma rays which it emits as it decays. An additional gamma source from the radioactivity in the condensate water storage tank volume is considered.

Unit 1 releases airborne effluents via four gaseous effluent release points to the environment. These are the radwaste building vent, the turbine building vent, the containment vent, and the auxiliary building vent. The mechanical vacuum pump exhausts to the turbine building vent, and the offgas system exhausts to the radwaste building vent (Reference 12CC-201, Section 11.3.3.2). The normal gaseous radiological effluent releases are obtained from Unit 1 Annual Radioactive Effluent Release Reports (ARERR). These reports for the years 2000 through ~~2003~~2007 were compared and the most limiting annual airborne radionuclide releases determined. The composite releases are given in Table 12CC-201.

Unit 1 releases radioactive liquid effluents via the radwaste discharge pipe which are diluted by mixing with the cooling tower blowdown flow of approximately 11,000 gpm (Reference 12CC-201, Section 11.2.3.2). These effluents are released directly to the Mississippi River via an underground pipe from the Unit 1 site to the river. Construction activities for Unit 3, at the river, would primarily be upstream of the Unit 1 release point for liquid effluents (See Figure 2.4.1-202). As

considered. The limiting χ/Q value for this evaluation is 1.10E-04 sec/m^3 in the WSW direction. The associated D/Q value for this location is 1.00E-07m^{-2}.

The GASPAR II computer code was used to determine the annual gaseous effluent release doses to the construction workers. GASPAR II provides doses expressed in terms of whole body and thyroid, whereas the acceptance criteria given in 10 CFR 20.1201 and 10 CFR 20.1301 are expressed in terms of Total Effective Dose Equivalent (TEDE). In order to compare GASPAR doses with acceptance criteria expressed in terms of TEDE, the thyroid dose is multiplied by 0.03 and the product added to the whole body dose per the instruction provided in RG 1.183. The doses are also adjusted for the actual time the construction workers will be on site by multiplying by a ratio of hours worked per year (assumed to be 2080 hours) to total number of hours in a year. Adjusted annual individual worker doses from airborne effluents by pathway are presented in Table 12CC-202. The total dose to an individual construction worker from Unit 1 operational airborne effluents is ~~1.5E-03~~2.1E-02 mSv (~~0.15~~2.12 mrem) TEDE.

12CC.3.3 Direct Radiation Dose

12CC.3.3.1 Radiation Sources Other than Unit 1 ISFSI

The doses to Unit 3 construction workers from direct radiation from contained radioactive sources within the Unit 1 facility are primarily determined based on the gamma doses ~~reported in GGNS AREORs. Thermoluminescent dosimeters~~ measured by thermoluminescent dosimeters (TLD). ~~(~~TLDs~~)~~ are used to measure ambient gamma radiation levels at many locations surrounding Unit 1. The TLDs on the protected area (PA) boundary surrounding the plant were used in determining the construction worker dose due to direct radiation from the Unit 1 facility from sources including the main turbine steam cycle, condensate storage tank and other potential sources. These TLDs are closer to Unit 1 than the Unit 3 construction areas; therefore, external whole body (gamma) dose results obtained from them conservatively bound the construction worker dose. Protected area boundary TLD gamma dose results were obtained ~~from the AREORs~~ for the years ~~2000~~2005, ~~2001~~2006, and ~~2002~~2007. These results are summarized in Table 12CC-203. The majority of the construction work is expected to be done to the west of Unit 1 in the Unit 3 powerblock and cooling tower areas. From Table 12CC-203, it can be seen that the protected area TLD readings on the west side of Unit 1 (M-63, M-64, M-65, M-74, M-76, M-77 and M-81) are significantly lower than other TLD readings. Given these factors, it is reasonable to use an average of all of the PA TLD data to determine external whole body dose for all Unit 3 construction areas. The three years of quarterly PA TLD data given in Table 12CC-203 are averaged and then multiplied by four to determine an annual average whole body dose of ~~1.56~~3.40 mSv/yr (~~156~~340 mrem/yr). Because background radiation levels for the years between 2000 and 2007 vary only slightly, the background radiation is taken to be the 2001 - 2005 control TLD location minimum (-2 standard deviations), 8 mrem/qtr (32 mrem/yr) (Reference 12CC-202). Therefore, the Unit 3 construction worker dose associated with direct radiation from Unit 1 is determined to be 3.08 mSv/yr (308 mrem/yr). Considering

considered. The limiting χ/Q value for this evaluation is 1.10E-04 sec/m^3 in the WSW direction. The associated D/Q value for this location is 1.00E-07m^{-2}.

The GASPAR II computer code was used to determine the annual gaseous effluent release doses to the construction workers. GASPAR II provides doses expressed in terms of whole body and thyroid, whereas the acceptance criteria given in 10 CFR 20.1201 and 10 CFR 20.1301 are expressed in terms of Total Effective Dose Equivalent (TEDE). In order to compare GASPAR doses with acceptance criteria expressed in terms of TEDE, the thyroid dose is multiplied by 0.03 and the product added to the whole body dose per the instruction provided in RG 1.183. The doses are also adjusted for the actual time the construction workers will be on site by multiplying by a ratio of hours worked per year (assumed to be 2080 hours) to total number of hours in a year. Adjusted annual individual worker doses from airborne effluents by pathway are presented in Table 12CC-202. The total dose to an individual construction worker from Unit 1 operational airborne effluents is ~~1.5E-03~~2.1E-03 mSv (~~0.15~~2.12 mrem) TEDE.

12CC.3.3 Direct Radiation Dose

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The doses to Unit 3 construction workers from direct radiation from contained radioactive sources within the Unit 1 facility are primarily determined based on the gamma doses ~~reported in GGNS AREORs. Thermoluminescent dosimeters~~ measured by thermoluminescent dosimeters (TLD). ~~(~~TLDs~~)~~ are used to measure ambient gamma radiation levels at many locations surrounding Unit 1. The TLDs on the protected area (PA) boundary surrounding the plant were used in determining the construction worker dose due to direct radiation from the Unit 1 facility from sources including the main turbine steam cycle, condensate storage tank and other potential sources. These TLDs are closer to Unit 1 than the Unit 3 construction areas; therefore, external whole body (gamma) dose results obtained from them conservatively bound the construction worker dose. Protected area boundary TLD gamma dose results were obtained ~~from the AREORs~~ for the years ~~2000~~2005, ~~2001~~2006, and ~~2002~~2007. These results are summarized in Table 12CC-203. The majority of the construction work is expected to be done to the west of Unit 1 in the Unit 3 powerblock and cooling tower areas. From Table 12CC-203, it can be seen that the protected area TLD readings on the west side of Unit 1 (M-63, M-64, M-65, M-74, M-76, M-77 and M-81) are significantly lower than other TLD readings. Given these factors, it is reasonable to use an average of all of the PA TLD data to determine external whole body dose for all Unit 3 construction areas. The three years of quarterly PA TLD data given in Table 12CC-203 are averaged and then multiplied by four to determine an annual average whole body dose of ~~1.56~~3.40 mSv/yr (~~156~~340 mrem/yr). Because background radiation levels for the years between 2000 and 2007 vary only slightly, the background radiation is taken to be the 2001 - 2005 control TLD location minimum (-2 standard deviations), 8 mrem/qtr (32 mrem/yr) (Reference 12CC-202). Therefore, the Unit 3 construction worker dose associated with direct radiation from Unit 1 is determined to be 3.08 mSv/yr (308 mrem/yr). Considering

an exposure period of 2080 hours per year, the adjusted annual average whole body dose associated with direct radiation to Unit 3 construction workers from Unit 1 is ~~0.3710~~0.73 mSv/yr (~~37.173~~ mrem/yr).

12CC.3.3.2 Direct Radiation Dose from the Unit 1 ISFSI

The Grand Gulf independent spent fuel storage installation (ISFSI) is located on the north side of the Unit 1 site and inside the protected area fence. The facility is being constructed in two phases. Phase 1 holds 48 casks and was made operational in 2007; four casks are loaded every 18 months, resulting in a fully loaded Phase 1 installation in approximately 2018. The need for the second phase of the ISFSI will be considered in the future. Dose rates associated with a completely loaded Phase 1 array are considered conservative for use when considering Unit 3 construction worker dose.

~~The~~A conservatively calculated near field gamma dose rate associated with a completely loaded Phase 1 ISFSI array varies from 0.04 to 1.0E-03 mSv/hr (4 to 0.1 mrem/hr) within the confines of the ISFSI fences. In general, the PA fence dose rate is calculated to be well below 0.02 mSv/hr (2 mrem/hr) except at the north end of the ISFSI. At this location, the dose is slightly above 2 mrem/hr; however, at the outermost (nuisance) fence in the same area the calculated dose rate is less than 2 mrem/hr in all locations. In accordance with the Grand Gulf Unit 1 Radiation Protection Program and Offsite Dose Calculation Manual, surveys of radiation levels in unrestricted and controlled areas on the site are performed to demonstrate compliance with 10CFR Part 20 dose limits for individual members of the public. Restrictions on access to areas where dose might exceed 10 CFR 20 dose limits are implemented, as required.

The ~~minimum~~ distance from the ISFSI to the centerline of the closest principal Unit 3 construction area, the Unit 3 switchyard, is estimated to be more than ~~114~~407 m (~~375~~1335 ft) based on Figure 2.4.1-201. For conservatism, a distance of ~~100~~375 m is used. From the GGNS ISFSI dose calculation, the total gamma and neutron far field dose rate at 375 meters is determined to be 2.85E-05 mSv/hr (2.85E-03 mrem/hr). ~~Neglecting attenuation, a 4 mrem/hr dose rate within the confines of the ISFSI is reduced to 4.0E-06 mSv/hr (4.0E-04 mrem/hr) at 100 m from the facility.~~ Considering an exposure period of 2080 hours per year, the maximum dose to a construction worker associated with the ISFSI is ~~8.0E-03~~5.9E-02 mSv/yr (~~0.8~~5.9 mrem/yr).

12CC.4 CONSTRUCTION WORKER DOSE ESTIMATES

Summing the doses determined above, the annual dose to construction workers in the Unit 3 construction areas as a result of radiation from the operating plant is ~~0.38~~0.81 mSv/yr (~~38~~81 mrem/yr) TEDE. Based on an exposure period of 2080 hours per year the ~~maximum~~average one hour dose occurring as a result of radiation from Unit 1 is ~~1.8E-04~~3.9E-04 mSv (~~1.8E-02~~3.9E-02 mrem) TEDE. The maximum dose in any unrestricted area from external sources, which potentially would occur at the north end of the ISFSI, is less than 0.02 mSv/hr (2 mrem/hr).

These doses are bounded by the 10 CFR 20.1301 individual dose limit of 1 mSv/yr (100 mrem/yr) TEDE and the 0.02 mSv/hr (2 mrem/hr) TEDE limit. The collective annual dose to the 3150 member workforce is ~~1.2~~2.55 person-Sv (~~120~~255 person-rem) TEDE. The construction worker doses for Unit 3 are bounded by the 10 CFR 20 limits and the design objective of 10 CFR 50 Appendix I limits.

The annual dose to an individual construction worker from the direct and airborne pathways is compared to the dose criteria in 10 CFR 20.1301 and 40 CFR 190 in Table 12CC-204 and Table 12CC-205, respectively. Comparison of the construction worker occupational dose to 10 CFR 20.1201 criteria is provided in Table 12CC-206. Annual dose to an individual is summarized in Table 12CC-207. Table 12CC-208 shows that the doses also meet the design objectives of 10 CFR 50, Appendix I, for gaseous effluents.

12CC.5 REFERENCES

12CC-201 Grand Gulf Nuclear Station Unit 1 Updated Final Safety Analysis Report, ~~June 2007~~September 2008

12CC-202 Grand Gulf Nuclear Station Annual Radiological Environmental Operating Report for ~~2000~~2005, April ~~16~~26, ~~2001~~2006 (ADAMS Accession No. ~~ML011080118~~ML062960151)

12CC-203 Grand Gulf Nuclear Station Annual Radiological Environmental Operating Report for ~~2001~~2007, April ~~24~~29, ~~2002~~2008 (ADAMS Accession No. ~~ML021200537~~ML081210455)

~~12CC-204 Grand Gulf Nuclear Station Annual Radiological Environmental Operating Report for 2002, April 15, 2003 (ADAMS Accession No. ML031120162)~~

12CC-20~~5~~4 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2000 – December 31, 2000, April 2, 2001 (ADAMS Accession No. ML011020305)

12CC-20~~6~~5 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2001 – December 31, 2001, April 16, 2002 (ADAMS Accession No. ML021150807)

12CC-20~~7~~6 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2002 – December 31, 2002, April 15, 2003 (ADAMS Accession No. ML031120183)

12CC-20~~8~~7 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2003 – December 31, 2003, April 28, 2004 (ADAMS Accession No. ML041260554)

12CC-208 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2004 - December 31, 2004, April 27, 2005 (ADAMS Accession No. ML051180372

12CC-209 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2005 - December 31, 2005, April 27, 2006 (ADAMS Accession No. ML061170561)

12CC-210 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2006 - December 31, 2006, April 30, 2007 (ADAMS Accession No. ML071200166)

12CC-211 Grand Gulf Nuclear Station Annual Radioactive Effluent Release Report, January 1, 2007 - December 31, 2007, April 28, 2008 (ADAMS Accession No. ML081210459)

TABLE 12CC-201
UNIT 1 ANNUAL GASEOUS RELEASES

GGNS SUP 12.4-1

Nuclide	Ci/yr	Nuclide	Ci/yr	Nuclide	Ci/yr
Ar41	~~9.75E-01~~ 8.51E+01	Xe137	2.45E-01	C058	~~1.48E-06~~ 9.71E-06
Kr85m	~~3.16E+00~~ 1.04E+02	Xe138	~~8.30E-01~~ 1.03E+02	Co60	~~1.23E-05~~ 2.36E-04
Kr87	~~1.36E-01~~ 4.10E+00	I130	1.90E-05	Cr51	~~3.28E-05~~ 1.67E-03
Kr88	~~2.10E+00~~ 7.40E+01	I131	~~1.60E-03~~ 4.28E-02	Cs137	~~0.00E+00~~ 1.12E-06
Kr89	5.98E-02	I132	~~8.28E-05~~ 2.43E-02	Fe59	~~0.00E+00~~ 1.53E-06
Xe131m	2.08E-01	I133	~~2.21E-03~~ 2.55E-02	Mn54	~~3.79E-06~~ 3.87E-05
Xe133	~~2.23E+01~~ 9.07E+01	I134	3.65E-03	NP239	1.90E-05
Xe133m	~~5.98E-02~~ 1.28E-01	I135	~~4.68E-04~~ 2.45E-02	Ru106	~~3.61E-06~~ 1.55E-05
Xe135	~~2.15E+01~~ 1.07E+02	Ba140	4.86E-05	Sr89	~~3.08E-06~~ 1.69E-05
Xe135m	~~1.17E+01~~ 9.27E+01	Ce141	5.32E-08	Zn65	~~1.77E-06~~ 3.59E-05
				H3	~~1.05E+02~~ 1.05E+02

GGNS SUP 12.4-1

TABLE 12CC-202
ADJUSTED ANNUAL INDIVIDUAL AIRBORNE DOSE (mrem (mSv)) SUMMARY BY PATHWAY

PATHWAY	T BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN	~~WHOLE BODY~~
PLUME	1.97E+00 (1.97E-02)	~~7.72E-02 (7.72E-04)~~ 1.97E+00 (1.97E-02)	~~7.72E-02 (7.72E-04)~~ 1.97E+0 (1.97E-02)	~~7.72E-02 (7.72E-04)~~ 1.97E+00 (1.97E-02)	~~7.72E-02 (7.72E-04)~~ 1.97E+00 (1.97E-02)	~~7.72E-02 (7.72E-04)~~ 1.97E+00 (1.97E-02)	~~7.81E-02 (7.81E-04)~~ 1.99E+00 (1.99E-02)	~~1.51E-01 (1.51E-03)~~ 3.40E+00 (3.40E-02)	~~7.72E-02 (7.72E-04)~~
GROUND	4.54E-03 (4.54E-05)	~~2.34E-04 (2.34E-06)~~ 4.54E-03 (4.54E-05)	~~2.34E-04 (2.34E-06)~~ 4.54E-03 (4.54E-05)	~~2.34E-04 (2.34E-06)~~ 4.54E-03 (4.54E-05)	~~2.34E-04 (2.34E-06)~~ 4.54E-03 (4.54E-05)	~~2.34E-04 (2.34E-06)~~ 4.54E-03 (4.54E-05)	~~2.34E-04 (2.34E-06)~~ 4.54E-03 (4.54E-05	~~2.75E-04 (2.75E-06)~~ 5.34E-03 (5.34E-05)	~~2.34E-04 (2.34E-06)~~
~~INHALATION~~ INHAL	6.34E-02 (6.34E-04)	~~6.24E-02 (6.24E-04)~~ 6.32E-02 (6.32E-04)	~~5.13E-05 (5.13E-07)~~ 1.16E-03 (1.16E-05)	~~6.24E-02 (6.24E-04)~~ 6.43E-02 (6.43E-04)	~~6.27E-02 (6.27E-04)~~ 6.55E-02 (6.55E-04)	~~8.24E-02 (8.24E-04)~~ 5.41E-01 (5.41E-03)	~~6.24E-02 (6.24E-04)~~ 6.39E-02 (6.39E-04)	6.24E-02 (6.24E-04)	~~6.24E-02 (6.24E-04)~~
TOTAL	2.04E+00 (2.04E-02)	~~1.40E-01 (1.40E-03)~~ 2.04E+0 (2.04E-02)	~~7.75E-02 (7.75E-04)~~ 1.98E+00 (1.98E-02)	~~1.40E-01 (1.40E-03)~~ 2.04E+00 (2.04E-02)	~~1.40E-01 (1.40E-03)~~ 2.04E+00 (2.04E-02)	~~1.60E-01 (1.60E-03)~~ 2.52E+00 (2.52E-02)	~~1.41E-01 (1.41E-03)~~ 2.06E+00 (2.06E-02)	~~2.14E-01 (2.14E-03)~~ 3.46E+00 (3.46E-02)	~~1.40E-01 (1.40E-03)~~
TEDE	2.12E+00 (2.12E-02)								~~1.45E-01 (1.45E-03)~~

Grand Gulf Nuclear Station, Unit 3
COL Application
Part 2, FSAR

TABLE 12CC-202
ADJUSTED ANNUAL INDIVIDUAL AIRBORNE DOSE (mrem (mSv)) SUMMARY BY PATHWAY

GGNS SUP 12.4-1

PATHWAY	T BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN	~~WHOLE BODY~~
COLLECTIVE[1] ~~DOSE~~	6.67E+03 (6.67E+01)								~~4.56E+02 (4.56E+04)~~

1. Collective dose for the estimated total construction work force.

TABLE 12CC-203
EXTERNAL WHOLE BODY (GAMMA) DOSE FROM PROTECTED AREA BOUNDARY TLDS

GGNS SUP 12.4-1

~~TLD~~ Station ~~Number~~	PA TLD Area Designation	Annual Mean Dose (mrem/qtr (mSv/qtr)) ~~2000~~2005	~~2001~~2006	~~2002~~2007
M 61	D	~~64.6 (0.646)~~94 (0.940)	~~54.7 (0.547)~~104.3 (1.043)	~~53.9 (0.539)~~97.1 (0.971)
M 62	E	~~86.7 (0.867)~~163.4 (1.634)	~~75.5 (0.755)~~174.2 (1.742)	~~78.2 (0.782)~~158.4 (1.584)
M 63	N	~~16.7 (0.167)~~39.1 (0.391)	~~16.3 (0.163)~~39.3 (0.393)	~~17.1 (0.171)~~41.4 (0.414)
M 64	M	~~21.9 (0.219)~~45.7 (0.457)	~~19.8 (0.198)~~49.1 (0.491)	~~19.6 (0.196)~~47.1 (0.471)
M 65	L	~~18.1 (0.181)~~30.9 (0.309)	~~17.3 (0.173)~~35.5 (0.355)	~~16.8 (0.168)~~35.5 (0.355)
M 66	K	~~23.2 (0.232)~~45.5 (0.455)	~~20.1 (0.201)~~49.1 (0.491)	~~20.4 (0.204)~~47.7 (0.477)
M 67	J	~~23.8 (0.238)~~41 (0.410)	~~20.9 (0.209)~~45.3 (0.453)	~~19.4 (0.194)~~42.9 (0.429)
M 68	H	~~97.9 (0.979)~~216.4 (2.164)	~~82.2 (0.822)~~233.7 (2.337)	~~82.6 (0.826)~~226.8 (2.268)
M 69	G	~~123.7 (1.237)~~271.5 (2.715)	~~106.1 (1.061)~~287.3 (2.873)	~~101.5 (1.015)~~283.1 (2.831)

TABLE 12CC-203
EXTERNAL WHOLE BODY (GAMMA) DOSE FROM PROTECTED AREA BOUNDARY TLDS

GGNS SUP 12.4-1

~~TLD~~ Station ~~Number~~	PA TLD Area Designation	Annual Mean Dose (mrem/qtr (mSv/qtr)) ~~2000~~2005	~~2001~~2006	~~2002~~2007
M 70	F	~~112.5 (1.125)~~240.4 (2.404)	~~95.8 (0.958)~~257.6 (2.576)	~~96.5 (0.965)~~223.6 (2.236)
M 71	C	~~31.6 (0.316)~~33.6 (0.336)	~~25.0 (0.25)~~30.2 (0.302)	~~22.1 (0.221)~~54.3 (0.543)
M 72	B	~~22.3 (0.223)~~30.3 (0.303)	~~19.2 (0.192)~~26.2 (0.262)	~~17.2 (0.172)~~35.4 (0.354)
M 74	Q	~~10.9 (0.109)~~18 (0.180)	~~9.9 (0.099)~~20.5 (0.205)	~~10.1 (0.101)~~21.6 (0.216)
M 76	A	~~16.8 (0.168)~~27.8 (0.278)	~~14.9 (0.149)~~16.9 (0.169)	~~13.7 (0.137)~~14.6 (0.146)
M 77	R	~~10.2 (0.102)~~14.7 (0.147)	~~9.7 (0.097)~~17.1 (0.171)	~~8.5 (0.085)~~17.1 (0.171)
M 81	P	~~9.7 (0.097)~~9 (0.090)	~~10.2 (0.102)~~9.7 (0.097)	~~8.4 (0.084)~~11.3 (0.113)
Average		~~43.2 (0.432)~~82.6 (0.826)	~~37.4 (0.374)~~87.3 (0.873)	~~36.6 (0.366)~~84.9 (0.849)

TABLE 12CC-204
COMPARISON OF CONSTRUCTION WORKER PUBLIC DOSE TO 10 CFR 20.1301 CRITERIA

GGNS SUP 12.4-1

Type of Dose	Annual Dose Limits	Estimated Dose
Whole body dose equivalent	100 mrem (1 mSv)	~~38~~81 mrem (~~0.38~~0.81 mSv)
Maximum dose rate in any hour	2 mrem/hr (0.02 mSv/hr)	~~1.8E-02~~<2 mrem/hr (~~1.8E-04~~<2E-02 mSv/hr)

TABLE 12CC-205
COMPARISON OF CONSTRUCTION WORKER PUBLIC DOSE FROM GASEOUS EFFLUENT DISCHARGES TO 40 CFR 190 CRITERIA

GGNS SUP 12.4-1

Type of Dose	Annual Dose Limits	~~Evaluated~~Estimated Dose
Whole body dose	25 mrem (0.25 mSv)	~~0.14~~2.04 mrem (~~1.4E-03~~2.04E-02 mSv)
Thyroid doses	75 mrem (0.75 mSv)	~~0.16~~2.52 mrem (~~1.6E-03~~2.52E-02 mSv)
Any Other Organ dose	25 mrem (0.25 mSv)	~~0.14~~2.06 mrem (~~1.4E-03~~2.06E-02 mSv)

Note:

1. 10 CFR 20 requires that the dose to an individual from radioactive effluents also meet 40 CFR 190 limits.

**TABLE 12CC-206
COMPARISON OF CONSTRUCTION WORKER
OCCUPATIONAL DOSE TO 10 CFR 20.1201 CRITERIA**

GGNS SUP 12.4-1

Type of Dose	Annual Dose Limit	~~Evaluated~~Estimated Dose
Whole body dose	5 rem (0.05 Sv)	~~3.8~~8.1E-02 rem (~~3.8~~8.1E-04 Sv)
Thyroid dose	50 rem (0.50 Sv)	~~3.8~~8.1E-02 rem (~~3.8~~8.1E-04 Sv)
Dose to the eye	15 rem (0.15 Sv)	~~3.8~~8.1E-02 rem (~~3.8~~8.1E-04 Sv)
Dose to skin or extremities	50 rem (0.50 Sv)	~~3.8~~8.1E-02 rem (~~3.8~~8.1E-04 Sv)

TABLE 12CC-207
ANNUAL CONSTRUCTION WORKER DOSES

GGNS SUP 12.4-1

	Annual Dose (mrem (mSv))		
	Whole Body	Critical Organ (Thyroid)	TEDE
Direct radiation	~~37.9~~79.0 (~~0.379~~0.790)	~~37.9 (0.379)~~79.0 (0.790)	~~39.04~~81.37 (~~0.39~~0.814)
Gaseous effluents	~~0.14~~2.04 (~~1.4E-03~~2.04E-02)	~~0.16~~2.52 (~~1.6E-03~~2.52E-02)	~~0.145~~2.12 (~~1.45E-03~~2.12E-02)
Total	~~38.04~~81.04 (~~0.38~~0.81)	~~38.06~~81.52 (~~0.381~~0.815)	~~39.10~~83.49 (~~0.392~~0.835)

Note:

1. A weighting factor of 0.03 is applied to the thyroid dose, which when added to the whole body dose gives the indicated TEDE dose (RG 1.183).

TABLE 12CC-208
COMPARISON WITH 10 CFR 50 APPENDIX I CRITERIA FOR EFFLUENT DOSES

GGNS SUP 12.4-1

	Annual Dose (mrem (mSv))	
	Annual Limit	Estimated Dose
Whole body dose from gaseous effluents	5 (0.05)	~~0.14~~2.04 (~~1.4E-03~~2.0E-02)
Skin dose from gaseous effluents	15 (0.15)	~~0.21~~3.46 (~~2.1E-03~~3.5E-02)

ATTACHMENT 2

G3NO-2008-00007

RESPONSE TO NRC RAI LETTER NO. 3

RAI QUESTION NO. 12.03-12.04-2

RAI QUESTION NO. 12.03-12.04-2

NRC RAI 12.03-12.04-2

FSAR Appendix 12CC provides an updated analysis of annual construction worker dose from Unit 1 airborne releases.

a. The analysis does not identify the limiting value used for the deposition factor (D/Q value) that is necessary to calculate ground-shine dose. Provide the limiting D/Q value used in the analysis to calculate the ground shine dose provided in Table 12CC-202.

b. FSAR Appendix 12CC use of airborne release quantities from the years 2001 to 2003 for the airborne dose calculation appears to be non-conservative. A confirmatory dose analysis using the range of potential airborne release quantities from the recent Unit 1 annual radioactive effluent release report indicates a potential construction worker dose between 5 to 15 times higher than the airborne dose given by the applicant for the years 2001 to 2003. Provide your reasoning for this apparent increase in airborne release quantities. Update the airborne release quantity data used to represent a more representative value and demonstrate that this value shows adequate conservatism, given that the airborne doses from Unit 1 appear to be increasing.

Entergy Response

The Grand Gulf Unit 3 Construction Worker Dose analysis has been updated to address increased gaseous radiological effluent from Unit 1 that has been measured in recent years. The increased radiological effluent is attributed to fuel failures occurring in Operating Cycles 13 and 15. The fraction of the construction worker dose attributed to gaseous effluent releases is relatively small (~2 mrem/yr) even with the past GGNS fuel failures. Consequently, there is adequate conservatism in the postulated construction worker doses.

FSAR Appendix 12CC draft revisions reflecting the updated construction worker dose analysis bases, assumptions and results are included with the response to RAI 12.03-12.04-1 in Attachment 1 to this letter. The D/Q value used in the analysis to calculate the ground shine dose is provided in Subsection 12CC.3.1 of the draft revised text.

Proposed COLA Revision

FSAR Appendix 12CC will be revised as indicated in the draft markup included with Attachment 1.

ATTACHMENT 3

G3NO-2008-00007

RESPONSE TO NRC RAI LETTER NO. 3

RAI QUESTION NO. 12.03-12.04-3

RAI QUESTION NO. 12.03-12.04-3

NRC RAI 12.03-12.04-3

FSAR, Appendix 12CC, Subsection 12CC.3.3.2 provides and analysis of the direct radiation dose from the Unit 1 independent spent fuel storage installation (ISFSI). A review of the direct radiation dose rates from the Grand Gulf Unit 1 ISFSI indicates potential radiation levels in excess of the 10 CFR 20.1301(a)(2) limit of 0.02 mSv/hr (2 mrem/hr) at the north end of the ISFSI. This section states that the Unit 1 ISFSI will be located on the north side of the Unit 1 site inside the protected area fence. The gamma dose rates and the distance from the ISFSI to the Unit 3 construction area are discussed. The distance from the ISFSI to the closest Unit 3 construction area has been estimated based on Figure 2.4.1-201. A review of the information in Subsection 12CC.3.3.2 and an examination of Figure 2.4.1-201 indicates that it is not clear where the ISFSI is located and where the dose rate exceeds 2 mrem/hr.

Accordingly,

a) Provide a site drawing showing the location of the ISFSI with respect to the Unit 3 construction site.

b) Provide a figure showing the potential combined gamma and neutron dose rate at the ISFSI fence line and the location of the Unit 1 protected area fence with respect to the Unit 3 construction site. Additionally, indicate any areas outside the Unit 1 protected area fence where the dose rate might exceed 2 mrem/hr. Describe any controls to insure that doses to construction workers will not exceed 2 mrem in any one hour in these areas.

Entergy Response

The Grand Gulf Unit 3 Construction Worker Dose analysis has been revised to update the methodology used to estimate the direct radiation dose from the Unit 1 ISFSI. FSAR Appendix 12CC draft revisions reflecting the updated construction worker dose analysis bases, assumptions and results are included with the response to RAI 12.03-12.04-1 in Attachment 1 to this letter. The response to RAI 12.03-12.04-1 also includes a site plan showing the location of the ISFSI with respect to principle Unit 3 construction areas as well as a figure showing the far-field isodose curves used in the dose analysis of the ISFSI.

The GGNS ISFSI is nearest the protected area fencing on the north and east sides of the ISFSI (see Figure 1 with response to RAI 12.03-12.04-1 in Attachment 1). In these areas, the fencing consists of three fences: an outermost nuisance fence, the Protected Area (PA) fence and an interior floppy fence. Each fence is separated by 20 feet; therefore, a 20' isolation zone is maintained on each side of the north PA fence. The near field gamma dose rate and neutron dose rate associated with a completely loaded ISFSI array varies within the confines of the ISFSI fences from 25 to 0.5, and 4 to 0.1 mrem/hr, respectively. In accordance with the Grand Gulf Unit 1 Radiation Protection Program and Offsite Dose Calculation Manual, surveys of radiation levels in unrestricted and controlled areas are performed to demonstrate compliance with 10 CFR Part 20 dose limits for individual members of the public. Restrictions on access to areas that might exceed 10 CFR 20 dose limits are implemented, as required.

Proposed COLA Revision

FSAR Appendix 12CC will be revised as indicated in the draft markup included with Attachment 1.

ATTACHMENT 4

G3NO-2008-00007

REGULATORY COMMITMENTS

REGULATORY COMMITMENTS

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
FSAR Appendix 12CC and associated tables will be revised as indicated in the draft markup included with Attachment 1.	✓		Future COLA submittal.