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

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-10244

Subject: **Update of Chapter 11 of US-APWR DCD**

Reference:
1) Letter CP-200901597 logged as TXNB-09074 from M.L. Lucas (Luminant) to U.S. NRC, "COMANCHE PEAK NUCLEAR POWER PLANT, UNITS 3 AND 4, DOCKET NUMBERS 52-034 AND 52-035, REVISION 1 TO THE COMBINED LICENSE APPLICATION," dated November 20, 2009
2) Letter MHI Ref: UAP-HF-09490 from Y. Ogata (MHI) to U.S. NRC, "Submittal of US-APWR Design Control Document Revision 2 in Support of Mitsubishi Heavy Industries, Ltd.'s Application for Design Certification of the US-APWR Standard Plant Design" dated on October 27, 2009.
3) NRC Request for Additional Information (RAI) No. 4315 Revision 1, RAI #145, 2/26/2010, Comanche Peak Units 3 and 4, Luminant Generation Company, LLC. Docket No. 52-034 and 52-035, SRP Section: 02.04.13 - Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters, Application Section: FSAR Section 2.4.13

During the review process of the Combined License Application for Comanche Peak Units 3 and 4 (Reference 1, "R-COLA"), which incorporates by reference the Mitsubishi Heavy Industries, Ltd. (MHI) Design Certification Application for the US-APWR Standard Plant Design (Reference 2, "DCD"), the U.S. Nuclear Regulatory Commission ("NRC") Staff has requested additional information about liquid containing tank failure analysis (Reference 3).

During development of the Luminant response to this RAI for the R-COLA, MHI has determined that updates of Chapter 11 of the MHI US-APWR Design Control Document are required.

With this letter, MHI transmits to the NRC Staff the proposed DCD updates necessary to support the Luminant response to this RAI. These updates will be incorporated in a future DCD revision.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this letter. His contact information is provided below.

D081
NRO

Sincerely,

Y. Ogata

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Update of Chapter 11 of the US-APWR DCD

CC: J. A. Ciocco
C. K. Paulson

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Enclosure 1

UAP-HF-10244
Docket No. 52-021

Update of Chapter 11 of US-APWR DCD

September 2010

Luminant received NRC Request for Additional Information No. 4315 Revision 1, RAI #145, dated on 2/26/2010.

During development of the response to the above RAI #145, MHI determined it was necessary to revise Chapter 11 of the US-APWR Design Control Document (DCD).

A mark-up draft of the DCD is attached in this document.

The individual doses are evaluated with LADTAP II Code (Ref. 11.2-14). The parameters used in the LADTAP II Code are listed in Table 11.2-14, and calculated doses are listed in Table 11.2-15. Based on these parameters, the dose to total body is 1.98 mrem/yr(Child) and the dose to organ is 2.54 mrem/yr (Child's liver). These values are less than the criteria of 3 mrem/y and 10 mrem/yr, respectively, as specified in 10 CFR 50 Appendix I (Ref. 11.2-2).

The COL applicant is to calculate doses to members of the public following the guidance of RG 1.109 (Ref 11.2-15) and RG 1.113 using site-specific parameters, and compares the doses due to the liquid effluents with the numerical design objectives of Appendix I to 10 CFR 50 (Ref 11.2-10) and compliance with requirements of 10 CFR 20.1302, 40 CFR 190.

11.2.3.2 Radioactive Effluent Releases due to Liquid Containing Tank Failures

In case of a failure of a tank containing radioactive liquid, the radioactive concentrations in the potable water supply located in the unrestricted area are evaluated with the procedure specified in NUREG-0133 Appendix A (Ref. 11.2-16), and the results are less than the limits of 10 CFR 20 Appendix B (Ref 11.2-8).

In the evaluation, the holdup tank, the waste holdup tank and boric acid tank are selected because they contain ~~a large~~ the largest amount of radioactivity. ~~The calculation model was based on the entire tank content directly released unmitigated to the groundwater system, the mixing and moving with the groundwater system. It is assumed that the released liquid is diluted with 4.4E+10 gallons of water until it reaches to the location of the potable water supply. This parameter is based on the conditions of actual sites. The model assumed the tank content is diluted with only this body of water in the vicinity of the ponds surrounding the site. No other water (such as other discharges and groundwater) is credited as dilution water, and no credit is taken for retardation or suspension of radionuclide in the subsurface media. Hence the conservative assumption that the radionuclides are not filtered (or reduced) by the soil is used. In addition, groundwater transport and soil properties are site-specific parameters.~~ Source term for each tank is provided in this DCD, and the ~~The~~ COL Applicant is responsible for site-specific assessment of the liquid containing tank failure analysis ~~this model~~ [COLA Item#11.2(3)] using the ~~site~~ site-specific parameters. ~~to evaluate the conservativeness of this analysis. In addition, the traveling time is assumed to be 365 days in order to cover the transfer rate of several radionuclides. Table 11.2-16 shows the evaluation conditions applied to each tank. The fuel defect level is set to 0.12% of the core thermal power, which is based on Branch Technical Position (BTP) 11-6 (Ref 11.2-17).~~

~~Table 11.2-17 shows the evaluation results of radioactivity concentration at the location of the potable water supply. The evaluation result obtained from the case of the failure of the boric acid tank, which has the largest value of 2.2E-01, indicates that the ratio of concentration is still less than the allowable value of 1.0, in accordance with 10CFR 20 Appendix B (Ref 11.2-8). Satisfying the concentration limits of 10 CFR 20 Appendix B (Ref 11.2-8) results in a dose of less than 50 mrem/yr that is required in 10 CFR 20.1301 and 10 CFR 20.1302 (Ref.11.2-1).~~ The source term is calculated in accordance with Branch Technical Position (BTP) 11-6 (Ref 11.2-17). BTP 11-6 Subsection B.2, endorses Appendix A of NUREG-0133, which describes the RATAF code for PWR plants. Accordingly, the RATAF code is utilized. ~~For the dominant nuclides Cs-134 and Cs-137, the reactor coolant activities calculated by the RATAF code are higher than the realistic source terms as described in Table 11.1-9 (ie.,1.4E-02 μCi/ml vs. 2.1E-05 μCi/g in Table 11.1-9 and 1.0E-02 μCi/ml vs. 3.0E-05 μCi/g in Table 11.1-9 for Cs-134 and Cs-137 respectively, with the conversion of 1g=1ml) and equal for tritium (H-3).~~ Table 11.2-16 shows input parameters for the RATAF code calculation. Table11.2-17 shows the source term calculated by the RATAF code. The concentrations of corrosion and activation products are the RATAF code output. And the concentrations of fission products are calculated by multiplying the RATAF code output by 0.12/1.0 to adjust the fuel defect level from 1% built-in the RATAF code to 0.12% recommended in BTP 11-6.

The COL applicant is responsible for providing the site-specific hydro-geological data ~~(such as contaminant migration time)~~, and analysis to demonstrate that the potential groundwater or surface water contamination concentration resulting from radioactive release due to liquid containing tank failure ~~is bounded by the analysis~~ is less than the 10CFR20, Appendix B, Table 2 Effluent Concentration Limits(ECLs). This evaluation is limited to the impact of radioactive effluent releases due to tank failure. Table 11.2-18 evaluates the failure of sumps, sump pumps, and drainage equipment. Since the Table 11.2-18 equipment items contain much smaller amount of liquid waste, the release impacts due to these equipment failures are minimal and are bounded by the impact of tank failure evaluated herein.

11.2.3.3 Offsite Dose Calculation Manual

The description for offsite dose calculation manual is given in Section 11.3.3.3.

11.2.4 Combined License Information

COL 11.2(1) *The COL applicant is responsible for ensuring that mobile and temporary liquid radwaste processing equipment and its interconnection to plant systems conforms to regulatory requirements and guidance such as 10 CFR 50.34a (Ref. 11.2-5), 10 CFR 20.1406 (Ref.11.2-7) and RG 1.143 (Ref. 11.2-3), respectively.*

COL 11.2(2) *Site-specific information of the LWMS, e.g., radioactive release points, effluent temperature, shape of flow orifices, etc., is provided in the COLA.*

COL 11.2(3) *The COL applicant is responsible for the ~~providing~~ site-specific hydrogeological data ~~(such as contaminant migration time)~~, and for performing an analysis to demonstrate that the potential groundwater or surface water contamination concentration resulting from a radioactive release due to liquid containing tank failure meets the 10CFR20, Appendix B, Table2 ECLs ~~-is bounded by the analysis discussed in Subsection 11.2.3.2~~.*

COL 11.2(4) *The COL applicant is to calculate doses to members of the public following the guidance of RG 1.109* (Ref 11.2-15) *and RG 1.113 using site-specific parameters, and compares the doses due to the liquid* *effluents with the numerical design objectives of Appendix I to 10 CFR 50* (Ref 11.2-10) *and compliance with requirements of 10 CFR 20.1302, 40 CFR 190.*

COL 11.2(5) The COL applicant is to perform a site-specific cost benefit analysis to demonstrate compliance with the regulatory requirements.

COL 11.2(6) The COL applicant is to provide piping and instrumentation diagrams (P&IDs).

11.2.5 References

11.2-1 Standards for Protection Against Radiation, NRC Regulations Title 10, Code of Federal Regulations, 10 CFR Part 20, December 2002.

11.2-2 Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low as is Reasonably Achievable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents, NRC Regulations Title 10, Code of Federal Regulations, 10 CFR Part 50, Appendix I .

11.2-3 Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants, Regulatory Guide 1.143, Rev. 2, November 2001.

11.2-4 General Design Criteria for Nuclear Power Plants, NRC Regulations Title 10, Code of Federal Regulations, 10 CFR Part 50, Appendix A.

11.2-5 Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents-Nuclear Power Reactors, NRC Regulations Title 10, Code of Federal Regulations, 10 CFR Part 50.34a.

11.2-6 Liquid Radioactive Waste Processing for Light Water Reactor Plants, ANSI/ANS 55.6, American National Standards Institute/American Nuclear Society, July 1993 (Revision 1999).

11.2-7 Minimization of Contamination, NRC Regulations Title 10, Code of Federal Regulations, 10 CFR Part 20.1406.

11.2-8 Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage, NRC Regulations Title 10, Code of Federal Regulations, 10 CFR Part 20, Appendix B.

11.2-9 Deleted

11.2-10 Domestic Licensing of Production and Utilization Facilities, Energy. Title 10, Code of Federal Regulations, Part 50, U.S. Nuclear Regulatory Commission, Washington DC.

11.2-11 Rules for Construction of Nuclear Power Plant Components, Boiler and Pressure Vessel Code. Section III, American Society of Mechanical Engineers, Washington DC.

11.2-12 Materials, Boiler and Pressure Vessel Code. Section II, American Society of Mechanical Engineers,.

11.2-13 Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors (PWR-GALE Code). NUREG-0017, Rev. 1, U.S. Nuclear Regulatory Commission, Washington, DC., April 1985.

11.2-14 LADTAP II Technical Reference and User Guide, NUREG/CR-4013, U.S. Nuclear Regulatory Commission, Washington, DC, April 1986.

11.2-15 Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Regulatory Guide 1.109, Rev. 1, U.S. Nuclear Regulatory Commission, Washington, DC, October 1977.

11.2-16 Preparation of Radiological Effluent Technical Specification for Nuclear Power Plants. NUREG-0133. U.S. Nuclear Regulatory Commission, Washington, DC., October 1978~~.Deleted~~

11.2-17 Postulated Radioactive Releases due to Liquid-Containing Tank Failures. Branch Technical Position 11-6, NUREG-0800, U.S. Nuclear Regulatory Commission, Washington DC., March 2007.

11.2-18 Estimating Aquatic Dispersion of Effluent from Accidental and Routine Releases for the Purpose of Implementing Appendix I, Regulatory Guide 1.113, Rev. 1,U.S. Nuclear Regulatory Commission, Washington DC., April 1977.

11.2-19 Compliance with Dose Limits for Individual Members of the Public Title 10, Code of Federal Regulations, 10 CFR Part 20.1302.

11.2-20 Environmental Radiation Protection Standards for Nuclear Power Operations Title 40, Code of Federal Regulations, 40 CFR Part 190.

11.2-21 Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors. Regulatory Guide 1.110, March 1976.

11.2-22 Standard Guide for Establishing Procedures to Qualify and Certify Inspection Personnel for Coating Work in Nuclear Facilities, American Society for Testing and Materials, ASTM D 4537-04a.

11.2-23 Standard Guide for Condition Assessment of Coating Service Level Coating Systems in Nuclear Power Plants, American Society for Testing and Materials, ASTM D 5163-08.

~~11.2-24 Radioactive Source Term for Normal Operation of Light Water Reactors, ANSI/ANS-18.1-1999, American National Standards Institute, American Nuclear Society. September 1999.~~

Table 11.2-16 Parameters for Calculation of Source term for Liquid Containing Tank Failures (4)(5)

Tank	Volume of tank (gal) (1)	Flow Rate (gpd)	Fraction of Reactor Coolant Activity (PCA)	Tank Factor(2) (3)
Holdup Tank	1.2E+5	Shim Bleed : 2875 Coolant Drain : 900	Shim Bleed : 1.0 Coolant Drain : 0.1	1.0 (All nuclides)
Waste Holdup Tank	3.0E+4	2023	0.18	1.0 (All nuclides)
Boric Acid Tank	6.6E+4	Shim Bleed : 2875 Coolant Drain : 900	Shim Bleed : 1.0 Coolant Drain : 0.1	1.0(Tritium) 0.2(Anion) 0.04(Cs,Rb) 0.2(Others)

Notes:

1. It is assumed that water equivalent to 80% of the tank volume is discharged. ~~and the volume of water contributing to dilution is 4.4E + 10 gal for defining the hydrological dilution factor of each tank. Hydrological Dilution Factor = 4.4E+10 / (Tank Volume x 0.8)~~
2. Tank factor is the ratio considering the removal effect by demineralizers or other treatment equipments prior to the tank.
3. The TFs of evaporators express the increase in concentration of radionuclides in the evaporator bottoms resulting from evaporator operation. The value of TF for evaporator is 0.02.
4. Dilution factor (1.00E-20) and travel time (0 days) input parameters do not directly affect the concentrations of the tanks. Because RATAF code only display results for significant concentrations at the critical receptor, these parameters were set in order to display all the nuclides described in table 11.2-17.
5. Other RATAF input parameters not described in this table are the same as PWR-GALE input parameters described in table 11.2-9.

Table 11.2-17 Source term for Liquid Containing Tank Failures

Isotope	Concentration in the tank (μCi/ml)(Note 2)		
	Holdup Tank	Boric Acid Tank	Waste Holdup Tank
Corrosion and activation products			
H-3	7.8E-01	7.4E-01	1.8E-01
Cr-51	7.7E-05	3.0E-05	1.6E-04
Mn-54	1.6E-05	4.2E-05	3.0E-05
Mn-56	Note 1		
Fe-55	8.6E-05	3.4E-04	1.6E-04
Fe-59	4.5E-05	2.5E-05	8.9E-05
Co-58	7.7E-04	6.4E-04	1.5E-03
Co-60	1.1E-04	4.8E-04	1.9E-04
Zn-65	Note 1		
W-187	Note 1		
Np-239	7.9E-05	1.4E-05	3.0E-04
Fission products			
Br-84	3.5E-07	6.4E-08	1.3E-06
Rb-88	6.2E-05	5.6E-05	6.0E-05
Sr-89	1.6E-05	1.0E-05	3.1E-05
Sr-90	5.4E-07	2.6E-06	9.7E-07
Sr-91	1.1E-06	2.0E-07	4.3E-06
Y-91m	7.3E-07	1.3E-07	2.8E-06
Y-91	3.4E-06	2.3E-06	6.4E-06
Y-92	Note 1		
Y-93	6.1E-08	1.1E-08	2.4E-07
Zr-95	2.9E-06	2.2E-06	5.5E-06
Nb-95	2.8E-06	3.1E-06	4.9E-06
Mo-99	7.8E-04	1.4E-04	2.9E-03

Note:
1. These radionuclides are listed in the Interim Staff Guidance on standard review plan section 11.2 and Branch Technical Position 11-6 but are not included in the RCS source term radionuclides list used by RATAF.

2. Adjusted values of RATAF output to 0.12% fuel defect level (except for corrosion and activation products).

Table 11.2-17 Source term for Liquid Containing Tank Failures

Isotope	Concentration in the tank (μCi/ml)(Note 2)		
	Holdup Tank	Boric Acid Tank	Waste Holdup Tank
Fission products			
Tc-99m	7.3E-04	1.3E-04	2.6E-03
Tc-99	1.6E-10	9.5E-10	2.4E-10
Ru-103	1.9E-06	1.0E-06	4.0E-06
Ru-106	5.3E-07	1.6E-06	9.6E-07
Ag-110m	Note 1		
I-129	9.2E-14	2.0E-12	8.6E-14
Te-129m	6.0E-05	2.6E-05	1.2E-04
Te-129	3.8E-05	1.7E-05	7.9E-05
Te-131m	1.1E-05	2.0E-06	4.3E-05
Te-131	2.2E-06	3.8E-07	8.2E-06
I-131	6.1E-03	1.2E-03	1.7E-02
Te-132	2.9E-04	5.3E-05	1.0E-03
I-132	3.4E-04	6.1E-05	1.2E-03
I-133	1.2E-03	2.3E-04	4.8E-03
I-134	1.0E-05	1.8E-06	4.0E-05
Cs-134	5.6E-03	1.1E-01	2.5E-03
I-135	2.4E-04	4.3E-05	9.2E-04
Cs-136	1.7E-03	2.0E-03	1.0E-03
Cs-137	4.1E-03	1.0E-01	1.8E-03
Ba-140	6.6E-06	1.6E-06	1.6E-05
La-140	7.4E-06	1.8E-06	1.7E-05
Ce-141	3.0E-06	1.3E-06	6.1E-06
Ce-143	1.9E-07	3.5E-08	7.4E-07
Ce-144	1.7E-06	4.3E-06	3.1E-06

Note:

1. These radionuclides are listed in the Interim Staff Guidance on standard review plan section 11.2 and Branch Technical Position 11-6 but are not included in the RCS source term radionuclides list used by RATAF.

2. Adjusted values of RATAF output to 0.12% fuel defect level (except for corrosion and activation products)

~~Table 11.2-17~~ Source term for Liquid Containing Tank Failures ~~Calculation Results of Effluent Concentrations due to Liquid Containing Tank Failures~~

~~1 : Holdup Tank~~

~~Isotope~~(1)	~~Concentration in the tank~~

	~~(µCi/ml)~~[(22)]
~~H-3~~	~~7.8E-01~~
~~Cs-134~~	~~4.75.6E-023~~
~~Cs-137~~	~~3.44.1E-023~~

~~Note:~~

~~1. Nuclides less than 1.0E-3 in fraction of concentration limit are excluded.~~

~~32. RATAF output based on 1% fuel defect level (except for tritium),Afor receptor location calculation,adjusted values of RATAF output to 0.12% fuel defect level (except for tritium)based on 0.12% fuel defect level (except for tritium)~~

~~2 : Waste Holdup Tank~~

~~Isotope~~[(1)]	~~Concentration in the tank (µCi/ml)~~[(32)]
~~Cs-134~~	~~2.15E-023~~
~~Cs-137~~	~~1.58E-023~~

~~Note:~~

~~1. Nuclides less than 1.0E-3 in fraction of concentration limit are excluded.~~

~~2. Adjusted values of RATAF output to 0.12% fuel defect level (except for tritium).~~

~~2. 10CFR20 Appendix B Table 2~~

~~3. RATAF output based on 1% fuel defect level~~

~~4. Adjusted values based on 0.12% fuel defect level~~

~~3 : Boric Acid Tank~~

~~Isotope~~[(1)]	~~Concentration in the tank (µCi/ml)~~[(32)]
~~Cs-134~~	~~1.21E+00-01~~
~~Cs-137~~	~~8.61.0E-01~~

~~Note:~~

~~1. Nuclides less than 1.0E-3 in fraction of concentration limit are excluded.~~

~~2. Adjusted values of RATAF output to 0.12% fuel defect level (except for tritium).~~

~~2. 10CFR20 Appendix B Table 2~~

~~3. RATAF output based on 1% fuel defect level~~

~~4. Adjusted values based on 0.12% fuel defect level~~