

REQUEST FOR ADDITIONAL INFORMATION 589-4536 REVISION 2

6/8/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 03.11 - Environmental Qualification of Mechanical and Electrical Equipment
Application Section: 3.11

QUESTIONS for Health Physics Branch (CHPB)

03.11-36

Question RAI 512-3893 03.11-29, requested additional information, beyond that provided in the response to RAI 358-2642 Question 03.11-1, about the methodology and assumptions used to calculate the Total Integrated Dose (TID) to equipment. In their response, the applicant provided a more detailed narrative description of the method used to establish the source term. The applicant also provided a general formula for calculating beta dose rates in water and air. However the response did not include the MicroShield input parameter data files and insufficient information was available to the NRC staff to allow confirmation of the TID values provided in MUAP-08015 Revision 1, Table 5-5 "Total Integrated Dose for Zone". In addition, the applicant did not justify the use of analytical methods that are not consistent with the guidance provided in Regulatory Guide 1.183 "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors". Examples of inconsistency include the omission of information regarding about how the contribution from the decay chains of the principle radionuclides are considered, how gamma and beta TID was calculated for points located on the surface of the water at the centerline of the large pool of sump water and the effects of activity plated out on containment surfaces on TID. Also, in their response, the applicant referenced NISTIR 5632 "Tables Of X-Ray Mass Attenuation Coefficients and Mass Energy Absorption Coefficients for 1 keV To 20 MeV for Elements Z = 1 To 92 and 48 Additional Substances of Dosimetric Interest" (NISTIR-5632) and Federal Guidance Report 12 "External Exposure To Radionuclides In Air, Water, And Soil" (FGR-12), that are not described in MUAP-08015 Revision 1, FSAR Revision 2 Tier 2 Sections 3.11 or FSAR Revision 2 Tier 2 Chapter 15 "Transient and Accident Analyses".

The applicant is requested to:

- Describe any computer codes, including revisions, besides MicroShield, that were used to calculate dose rates and the resultant Total Integrated Dose (TID) to equipment,
- Provide a sample calculation performed by the applicant to calculated dose rates and the resultant TID resulting from liquids, plated out material and airborne activity, including the input parameter and output data files of MicroShield and any other computer codes used for the analysis.
- Describe the basis for any assumed parameters, such as the Geometry Correction Factor, or the type of surface selected to represent a plate out source.

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- Describe the methods for averaging dose rate to obtain TID for the stated intervals, and for interpolating the Source Strength at Time after Release provided in Table 1, and the Operational Durations specified in MUAP-08015(R1) Table 5-5.
- Revise and update either MUAP-08015 Revision 1 or FSAR Revision 2 Tier 2 Section 3.11 to include a complete description of the methods and assumptions, and referenced documents, used to calculate equipment TID.

Reference: MHI's Response to US-APWR DCD RAI No. 512-3893; MHI Ref: UAP-HF-10018; Dated January 28, 2010; ML100330613.

03.11-37

Question RAI 512-3893 03.11-30, requested additional information, beyond that provided in the response to RAI 358-2642 Question 03.11-1, about the source term used to calculate the Total Integrated Dose (TID) to equipment. In their response, the applicant stated that, except for radiological decay, the effects of other removal mechanisms for reducing containment source terms used to calculate the concentrations presented in FSAR Revision 2 Tier 2 Table 15A-15 "The Peak Concentration in Containment During LOCA" were not used for calculating TID. The applicant noted that the source terms used were provided in Table 1 of the response to Question RAI 512-3893 03.11-29. However, since the effective beta energy is dependent on the assumed isotopic concentration, insufficient information has been provided by the applicant to allow confirmation of the reported energy distributions and resultant dose rates and TID.

The applicant should revise and update MUAP-08015 Revision 1 or FSAR Revision 2 Tier 2 Chapter 3.11 to provide the airborne activity concentrations used to determine equipment gamma and beta TID, or provide the specific alternative approaches used and the associated justification.

References:

MHI's Response to US-APWR DCD RAI No. 512-3893; MHI Ref: UAP-HF-10018; Dated January 28, 2010; ML100330613.

MHI's Response to US-APWR DCD RAI No. 358-2642; MHI Ref: UAP-HF-09371; Dated July 10, 2009; ML091970103.

03.11-38

US-APWR DCD Tier 2 Revision 2 Table 3D-1 "Equipment Post-Accident Operability Times" notes that some equipment required to be operable for 2 weeks is located outside containment, is accessible, and can be repaired, replaced, or recalibrated. This table also notes that some equipment is located inside containment, is inaccessible and is required for post-accident monitoring is required to be operable for 4 months. Table 3D-2 "US-APWR Environmental Qualification Equipment List" was revised in response to DCD RAI 358-2462 Question 03.11-2. This question asked for information regarding the location of equipment requiring qualification and additional details regarding the

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radiation dose to which the equipment must be qualified. RAI 262-1972 Question 12.03-12.04-16 asked the applicant to identify any entries required into vital areas for the event duration and to provide the associated mission doses in DCD Tier 2 section 12.4.

However, based on the information provided by the applicant, the NRC staff is unable to: (1) determine the event duration, and the basis for the selection of that duration, (2) determine if any equipment listed in Table 3D-2 is expected to need replacement, recalibration or repair for the duration of the event. Also, in light of the high dose rates experienced inside the containment building following the accident at Three Mile Island Unit 2, and the resultant effort required to reenter the containment building, the NRC staff would like the applicant to provide additional information describing why accessing equipment inside containment for calibration, repair or replacement, within the 4 months service time noted in Table 3D-1, meets the requirements of 10 CFR 20.1101(b) for maintaining Operational Radiation Exposure ALARA.

The applicant is requested to revise the US-APWR DCD Appendix 3D, section 12.4 and other sections as necessary, to include information regarding the event duration and methods, basis and assumptions used to determine that interval, especially as it relates to areas which will have radiologically harsh environments. The applicant is also requested to clearly describe in Table 3D-1, those pieces of equipment located in the radiologically controlled vital areas of the plant that will require replacement, calibration, or repair for the duration of the event, and to provide Mission Doses for the identified pieces of equipment in DCD Chapter 12.4.

References:

MHI's Response to US-APWR DCD RAI No. 262-1972; MHI Ref: UAP-HF-09226; Dated May 7, 2009; ML091320442.

MHI's Response to US-APWR DCD RAI No. 358-2642; MHI Ref: UAP-HF-09371; Dated July 10, 2009; ML091970103.