REQUEST FOR ADDITIONAL INFORMATION 202-1846 REVISION 0

2/25/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 04.03 - Nuclear Design
Application Section: MUAP-07019-P (R0), "US-APWR Qualification of Nuclear Design Methodology using PAROGON/ANC."

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)

04.03-1

Page 1 – Reference is made at several locations within the document to a "--- previously approved by the US NRC" code package. Has the PARAGON code package and other codes referenced in this document have been changed or modified in any manner relative to that approved by the US NRC? Provide approval references of all the codes referenced in this technical report. This question is asked to satisfy GDC10 requirements.

04.03-2

Page 3 – A 70 energy group library is referred to. How many of these groups are thermal (below ~ 0.625 eV), how many are in the resonance range (resolved and unresolved), how many in the high energy range? This question is asked to satisfy GDC10 requirements.

04.03-3

How are the resonance cross sections treated in this code (PARAGON)? This question is asked to satisfy GDC10 requirements.

04.03-4

Page 3 – Since, there is no modal shape in the reflector how are few group cross sections determined for the reflector regions? This question is asked to satisfy GDC10 requirements.

04.03-5

Page 3 – The ANC core simulator calculates a variety of parameters. What is meant by "--- core stability and other nuclear parameters"? This question is asked to satisfy GDC10 requirements.

04.03-6

Page 4 – How are the few group cross sections arrived at, particularly since the steel has a significant resonance structure (both positive resonance's, and negative resonance's, particularly iron)? This question is asked to satisfy GDC10 requirements.

04.03-7

Page 5 – Summarize the critical experiment results referred to in Reference 1. This question is asked to satisfy GDC10 requirements.

04.03-8

Page 6 – What are the Saxton and Yankee results? Summarize the data presented in Reference 1. This question is asked to satisfy GDC10 requirements.

04.03-9

Page 7 and Figs. 3.1-8, 3.1-9 – What is the magnitude of the error bars on the results? Is there a reason for the systematic error associated with the plutonium isotopes (Fig 3.1-9 MOX fuel)? This question is asked to satisfy GDC10 requirements.

04.03-10

Page 7, the calculations and measurements shown on Fig. 3.1-10 and 3.1-11 show good agreement. Provide a detailed description how the space and energy dependent burnup is modeled in PARAGON for these experiments. How does this experience translate into accurately predicting the behavior of gadolinia burnup in the actual US-APWR, which might have its gadolinia in a different arrangement from that in the test reactor experiment? This question is asked to satisfy GDC10 requirements.

04.03-11

Provide history of MHI experience using PARAGON to high burnup? What documentation is available to validate that this code package can accurately predict the burnup behavior to the high burnup levels expected in the US-APWR? This question is asked to satisfy GDC10 requirements.

04.03-12

Page 8 – What is the configuration of the TCA critical experiment? Discuss the analysis technique used to arrive at answers. Page 25 and Figs. 3.2-1 – 3.2-3 – identify the different plants and cycle number on these plots. This question is asked to satisfy GDC10 requirements.

04.03-13

Page 25 and Fig. 3.2-4 – Provide definition of "stability index". This question is asked to satisfy GDC10 requirements.

04.03-14

Page 26 – Are any of the few group cross sections adjusted based on level of agreement with critical experiments or are the ENDF/B data used without adjustment? This question is asked to satisfy GDC10 requirements.