

Date of Document July 15, 2010

**PWR-GALE COMPUTER CODE FOR CHAPTER 11 AUDIT PLAN**

**JULY 28 - 30, 2010**

**US-APWR DESIGN CERTIFICATION  
Mitsubishi Heavy Industries, Ltd.  
Docket No. 52-021**

Location: Mitsubishi Nuclear Energy Systems, Inc.  
1001 19<sup>th</sup> Street North, Arlington, VA

Purpose:

The purpose of the audit is to meet with Mitsubishi Heavy Industries, Ltd. (MHI) technical staff to review and discuss the modified PWR-GALE computer code, and the proposed revision to Design Control Document (DCD) Section 11.2.3.2. The audit will include verification and demonstration of the PWR-GALE computer code values related to Request for Additional Information (RAI) responses. The NRC staff will determine compliance with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Parts 20, 50, and 52, as well as Title 40 of the *Code of Federal Regulations* (40 CFR), Part 190, that pertain to the U.S. Nuclear Regulatory Commission (NRC) staff's safety evaluation, confirmatory calculations, and other existing questions on Chapter 11 of the United States - Advanced Pressurized Water Reactor (US-APWR) DCD. The NRC staff will evaluate the basis of MHI's responses, calculation packages, and other documents to determine the closure of the RAIs, or to develop supplemental questions as needed.

Background:

MHI had submitted to the NRC, Revision 0 of the DCD for its initial application of the US-APWR dated December, 2007. The NRC staff is currently reviewing Revision 2 of the DCD submitted to the NRC dated October, 2009. In its review of DCD Tier 2, Chapter 11, "Radioactive Waste Management," Sections 11.2, "Liquid Waste Management System" and Section 11.3, "Gaseous Waste Management System," the NRC staff has issued RAIs on the design, input parameters and assumptions, and basis of the modified PWR-GALE computer code, and the calculated liquid and gaseous effluent releases and doses used to demonstrate compliance with 10 CFR, Parts 20, 50, and 52, and 40 CFR, Part 190.

The modified PWR-GALE computer code impacts several key areas such as liquid and gaseous effluent releases, cost-benefit analysis, charcoal bed leak, and doses. The planned audit will help facilitate the resolution of the RAIs in question to determine closure or the need to issue additional RAIs. The audit will also facilitate the NRC staff's review of the Comanche Peak Nuclear Power Plant (CPNPP), Units 3 and 4, Combined License (COLA) (Reference COLA for the US-APWR) because the doses presented in the Final Safety Analysis Report (FSAR) Chapter 11 from Combined License (COL) information items in the US-APWR DCD are developed from the liquid and gaseous effluent releases calculated with the MHI PWR-GALE computer code.

The NRC staff issued CPNPP, Units 3 and 4, (Reference COLA for the US-APWR) RAI 4315 (CP 145) for the FSAR, Section 2.4.13 asking the COLA applicant to justify the applicability of the liquid tank failure evaluation in the DCD as the bounding analysis for the site-specific evaluation of the CPNPP, Units 3 and 4. As a result of the RAI, a revision to DCD Section 11.2.3.2 which involves the deletion of the liquid tank failure analysis, a change to COL information item 11.2(3), and new calculations of failed liquid tank concentrations using the ANSI/ANS-N18.1-1999 methodology is proposed by MHI. The NRC staff plans to review and discuss with MHI, its methodology to calculate the new liquid tank concentrations. The audit will facilitate resolution of the RAI (CP 145) associated with the COLA and the NRC staff's review of the proposed revision of DCD Section 11.2.3.2 on the liquid tank failure analysis.

Regulatory Audit Basis:

The information below lists the regulatory basis for the audit.

- 10 CFR, Part 20, "Standards for Protection Against Radiation."
- NUREG-0800, "Standard Review Plan," Chapter 11, "Radioactive Waste Management."
- 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 60, "Control of Releases of Radioactive Materials to the Environment."
- 10 CFR Part 50, Appendix A, GDC 64, "Monitoring Radioactivity Releases."
- 10 CFR Part 50, Appendix I, "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."
- 10 CFR 50.34a, "Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents - Nuclear Power Reactors."
- 10 CFR 50.36, "Technical Specifications."
- 10 CFR 50.9, "Completeness and Accuracy of Information."
- 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."
- 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."
- RG 1.109, "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."
- RG 1.112, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors."
- RG 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures and Components Installed in Light-Water-Cooled Nuclear Reactor Power Plants."

- RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."
- NUREG-0017, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors (PWRs) (PWR-GALE Code)."
- NUREG-0800, "Standard Review Plan," Chapter 11, "Radioactive Waste Management."
- BTP 11-5, "Postulated Radioactive Releases Due to a Waste Gas System Leak or Failure."
- BTP 11-6, "Postulated Radioactive Releases due to Liquid-Containing Tank Failures."
- NUREG/CR-4653, "GASPAR II - Technical Reference and User Guide."
- NUREG/CR-4013, "LADTAP II - Technical Reference and User Guide."
- ANSI/ANS-18.1-1999, "Radioactive Source Term for Normal Operation of Light Water Reactors."

#### Regulatory Audit Scope:

The audit scope will consist of a review and discussion of MHI's responses to RAIs related to the MHI PWR-GALE computer code incorporating the American National Standards Institute/American Nuclear Society (ANSI/ANS)-18.1-1999 source term and the 0.02 percent per day noble gases leakage rate (DCD Tables 11.2-9 and 11.3-4), and the calculated liquid (DCD Tables 11.2-10, 11.2-11, 11.2-12, and 11.2-13) and gaseous (DCD Tables 11.3-5, 11.3-6, and 11.3-7) effluent releases and the liquid (DCD Table 11.2-15) and gaseous (DCD Tables 11.3-4, 11.3-8, and 11.3-9) effluent doses (see References). The audit will also consist of a review and discussion on the proposed revision to DCD Section 11.2.3.2 including the new calculations of the failed liquid tank concentrations using the ANSI/ANS-N18.1-1999 methodology. To facilitate the audit, it is expected that MHI will provide a demonstration of the PWR-GALE computer code and any additional supporting documents and technical evidence to the NRC staff (see Information and Other Material Necessary for the Audit). The NRC staff will document the audit findings in an audit report and, as needed, through supplemental RAIs.

#### Information and Other Material Necessary for the Audit:

The NRC requests that MHI provide any calculation packages to support responses to RAIs and discussions on the liquid and gaseous and effluent releases (during normal operation including anticipated operational occurrences and maximum defined fuel defects) and doses, the waste gas surge tank and charcoal bed leak doses, and the new failed liquid tank concentrations. In addition, the NRC staff requests any additional quality assurance documents to support modification of the PWR-GALE computer code and information describing the basis to develop the new failed liquid tank concentrations using the ANSI/ANS-N18.1-1999 methodology.

Audit Team:

- Richard Clement, NRC, Chapter 11 Technical Reviewer for the US-APWR DCD and CPNPP, Units 3 and 4, COL FSAR
- Ngola Otto, NRC, Chapter 11 Project Manager for the US-APWR DCD and CPNPP, Units 3 and 4, COL FSAR

Logistics:

The audit will be performed at the Mitsubishi Nuclear Energy Systems, Inc. (MNES) in Arlington, VA. A proposed agenda for the audit is supplemented as the Enclosure. The NRC staff will conduct the audit over a period not to exceed three business days. The NRC may request an ad-hoc extension of the audit at the same location if findings during the ongoing audit reveal the need for additional time. Such an extension will be requested before the meeting is adjourned by the NRC Project Manager. If necessary, any circumstances related to the conductance of the audit will be communicated to Ngola Otto (NRC) at (301) 415-6695 or via e-mail to [Ngola.Otto@nrc.gov](mailto:Ngola.Otto@nrc.gov).

Special Requests:

The MHI staff cognizant of the basis and modifications made to the PWR-GALE computer code shall participate in the audit. MHI staff, knowledgeable of the liquid and gaseous effluent releases and dose calculations in DCD Sections 11.2 and 11.3 (including the waste gas surge tank and charcoal bed leak dose calculations) and calculations on the failed liquid tank concentrations in DCD Section 11.2.3.2 shall participate in the audit. Appropriate handling and protection of proprietary information shall be acknowledged and observed throughout the audit.

Deliverables:

An audit report will be generated after completion of the audit. The audit outcome will be used to identify any additional information to be submitted for making regulatory decisions. The audit will assist the NRC staff in the preparation and issuance of further RAIs, as needed, for the licensing review on Chapter 11 of the US-APWR DCD and the CPNPP, Units 3 and 4, COLA FSAR.

References:

1. US-APWR DCD Revision 2.
2. Response to RAI 164-1925, Questions 11.02-4 and 11.02-7: Enclosures 1 and 2 (ML090570441), and Enclosure 3 (Non-Publicly Available).
3. Response to RAI 523-4246, Question 11.02-30 (ML100770379).
4. Response to RAI 189-2006, Questions 11.03-6, 11.03-7, and 11.03-8: Enclosures 1 and 2 (ML090770414), and Enclosure 3 (Non-Publicly Available).

5. Response to RAI 402-3028, Questions 11.03-12: Enclosure 5 and 8 (Non-Publicly Available). Response to RAI 402-3028, Question 11.03-12 and 11.03-13: Enclosure 6 (ML092090556).
6. English translation of the PWR-GALE Quality Assurance Documents: Enclosure 2 (Non-Publicly Available).
7. Proposed revision to DCD Section 11.2.3.2 (to be docketed later).

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cc: See next page

5. Response to RAI 402-3028, Questions 11.03-12: Enclosure 5 and 8 (Non-Publicly Available). Response to RAI 402-3028, Question 11.03-12 and 11.03-13: Enclosure 6 (ML092090556).
6. English translation of the PWR-GALE Quality Assurance Documents: Enclosure 2 (Non-Publicly Available).
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Proposed Agenda

Wednesday, July 28, 2010  
8:00 a.m. - 3:00 p.m.

Mitsubishi Nuclear Energy Systems, Inc.  
1001 19<sup>th</sup> Street North  
Arlington, VA

<u>TIME</u>	<u>TOPIC</u>	<u>LEAD</u>
8:00 a.m. - 9:00 a.m.	Entrance/Introduction	NRC/MHI
9:00 a.m. - 12:00 p.m.	Overview: Discussion of RAI Responses and the Proposed Revision to DCD Section 11.2.3.2	NRC/MHI
12:00 p.m. - 1:00 p.m.	Lunch	ALL
1:00 p.m. - 3:00 p.m.	Demonstration of the MHI PWR-GALE Computer Code	NRC/MHI
3:00 p.m.	Adjourn / Exit	

Enclosure

Proposed Agenda

Thursday, July 29, 2010

8:00 a.m. - 3:00 p.m.

Mitsubishi Nuclear Energy Systems, Inc.

1001 19<sup>th</sup> Street North

Arlington, VA

<u>TIME</u>	<u>TOPIC</u>	<u>LEAD</u>
8:00 a.m. - 12:00 p.m.	NRC Audit of the Available Documentation	NRC/MHI
12:00 p.m. - 1:00 p.m.	Lunch	ALL
1:00 p.m. - 3:00 p.m.	NRC Audit of the Available Documentation	NRC/MHI
3:00 p.m.	Adjourn / Exit	



Proposed Agenda

Friday, July 30, 2010

8:00 a.m. - 3:00 p.m.

Mitsubishi Nuclear Energy Systems, Inc.

1001 19<sup>th</sup> Street North

Arlington, VA

<u>TIME</u>	<u>TOPIC</u>	<u>LEAD</u>
8:00 a.m. - 12:00 p.m.	NRC Audit of the Available Documentation	NRC/MHI
12:00 p.m. - 1:00 p.m.	Lunch	ALL
1:00 p.m. - 2:30 p.m.	NRC Audit of the Available Documentation	NRC/MHI
2:30 p.m. - 3:00 p.m.	Audit Summary and Next Steps	NRC/MHI
3:00 p.m.	Adjourn / Exit	

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(Revised 06/23/2010)

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