May 16, 2011

DESIGN CERTIFICATION CHAPTER 19, SECTION 17.4 AND PROBABLISTIC RISK ASSESSMENT AUDIT PLAN

May 19 - 23, 2011

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

Location: Mitsubishi Nuclear Energy Systems, Inc.
1001 19th Street North, 7th Floor
Arlington, VA 22209

Purpose:

The purpose of the regulatory audit is to support resolving the outstanding technical issues as part of Phase 2 of the safety evaluation review of the United States - Advanced Pressurized Water Reactor (US-APWR) Design Control Document (DCD). The audit will provide clarification, supporting information, and technical evidence to the reviewers. To the extent applicable, the audit will examine information and documentation that is related to the low power and shutdown probabilistic risk assessment (PRA), internal fire PRA, internal flood PRA, Level 2 PRA, severe accident assessment, and impact of the forthcoming Revision 3 of the PRA regarding the reliability assurance program (RAP) risk-significant structures, systems, and components (SSCs) list.

Background:

Mitsubishi Heavy Industries, Ltd. (MHI) submitted to the U.S. Nuclear Regulatory Commission (NRC) a DCD for its application of the US-APWR design certification (DC) in December 2007. During the review of the US-APWR DCD Revision 3, docketed in March 2011, the PRA staff in the Office of New Reactors, PRA & Severe Accident Branch identified the need for additional clarification concerning the information presented in DCD Section 17.4, Chapter 19, and the PRA models/results.

The NRC staff is proposing a three day audit that will be conducted at the Mitsubishi Nuclear Energy Systems Inc. (MNES) facilities located in Arlington, Virginia, to gain an understanding of the basis of the submitted information and calculations. The audit is needed to support the resolution of issues and accomplishing the US-APWR review schedule in an efficient manner.

Regulatory Audit Basis:

- Title 10 of the *Code of Federal Regulations* (10 CFR) Section 52.47, "Contents of applications; technical information," Section 52.47(a)(8) requires the information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except 50.34(f)(1)(xii), f(2)(ix), and f(3)(v).

- 10 CFR 52.47(a)(23) requires a description and analysis of design features for the prevention and mitigation of severe accidents.

- 10 CFR 52.47(a)(27) requires a description of the design-specific PRA and its results.

- 10 CFR 52.47(b)(1) requires that the application for a DC must contain proposed inspections, tests, analyses, and acceptance criteria, which are necessary and sufficient to provide reasonable assurance that, if the tests, inspections, and analyses are performed and the acceptance criteria are met, a plant that references the design is built and will operate in accordance with the DC.

Regulatory Audit Scope:

The specific scope of this audit will be the low power and shutdown (LPSD) PRA for internal events, internal fire PRA, internal flood PRA, Level 2 PRA, severe accidents, and RAP risk-significant SSCs list.

1. For the low power and shutdown PRA, this audit will focus on those shutdown operations and shutdown thermal hydraulics that are considered especially important to the shutdown risk assessment of a new pressurized water reactor design, including, but not limited to, the following:

    a. Discussion on the shutdown model in the DCD Revision 3.

    b. Implementation of Generic Letter (GL) 88-17 recommendations concerning the need for a large reactor coolant system (RCS) vent path to prevent pressurization of the upper plenum during nozzle dam installation. Reference: Request for Additional Information (RAI) 19-492 and NRC Information Notice 88-36.

    c. Implementation of GL 88-17 recommendations regarding nozzle dam installation and removal operations. Reference: RAI 19-492 and NRC Information Notice 88-36.

    d. Feasibility of gravity feed and steam generator (SG) cooling during shutdown operations with nozzle dam installation and removal.

    e. MHI's response to RAI 19-438.

f. Modular Accident Analysis Program analyses that supports MHI's response to RAI 19-492.

g. Duration of time for the installation and removal of the in-core instrumentation system. Reference: RAI 19-493.

h. MHI's response to RAI 19-494.

i. MHI's response to RAI 19-495. Availability of the test data that describes hotleg levels at which vortexing initiates for the highest Residual Heat Removal flow rates anticipated for midloop operation.

j. MHI's response to RAI 19.01-9.

k. Potential RCS drain paths when the refueling cavity is flooded.

l. Planned RCS water level for the nozzle dam installation relative to the inside bottom on the vessel: the base elevation of the manway (lowest elevation) relative to the inside bottom of the vessel; and the top elevation of the manway (highest elevation) relative to the inside bottom of the vessel.

2. For the internal fire PRA, the audit will focus on the following areas:

a. Differences between the DCD, Revision 2 information and the DCD, Revision 3 information.

b. Differences between fire PRA Revision 2 results and the Revision 3 results (i.e., accident sequences, cutsets, importance ranking, conclusion, etc.).

c. Modification to the key assumptions.

d. Adjustment to fire scenarios and models.

e. Additional risk insights gained from PRA, Revision 3.

3. For the internal flood PRA, the audit will focus on the following areas:

a. Differences between the DCD, Revision 2 information and the DCD, Revision 3 information.

b. Differences between the internal flood PRA Revision 2 results and the Revision 3 results (i.e., accident sequences, cutsets, importance ranking, conclusion, etc.).

c. Modification to the key assumptions.

d. Adjustment to internal flood scenarios and models.

e. Additional risk insights gained from PRA, Revision 3.

4. and 5. For the Level 2 PRA and severe accident analysis, the audit will focus on the following areas:

a. Differences between the DCD, Revision 2 information and the DCD, Revision 3 information.

b. Differences between the Level 2 PRA Revision 2 results and the Revision 3 results.

c. Time-dependent source terms for the release categories used in the Severe Accident Mitigation Design Alternative evaluations (for internal events at power, internal fires, internal floods, and LPSD events).

d. Any available draft responses to Question 19-520 in RAI 752-5614.

e. Ex-vessel steam explosion analyses.

f. Any available draft responses to Question 19-521 in RAI 752-5614.

g. Analysis of hydrogen buildup in the refueling water storage pit.

h. Any available draft responses to Question 19-522 in RAI 752-5614.

i. Temperature-induced SG tube rupture results.

j. Any available draft responses to Question 19-523 in RAI 752-5614.

k. Severe Accident Management framework during operations at power and during LPSD operations.

l. Equipment survivability analysis results.

6. For the RAP risk-significant SSCs list, the audit will focus on the following areas:

a. Differences between the DCD, Revision 2 information and the DCD, Revision 3 information.

b. Differences between the PRA Revision 2 and the PRA Revision 3.

<u>Information and Other Material on Hand for the Audit</u>:

- Low power and shutdown PRA Revision 3 (or draft information).
- Internal fire PRA Revision 3 (or draft information).
- Internal floods PRA Revision 3 (or draft information).
- Severe accident assessments.

- Plant-specific analyses that provide information used to support low power, shutdown, fire and flood PRAs and severe accident assessment.

- The RAP risk-significant SSCs list, if revised based on PRA draft Revision 3

Audit Team:

Hanh Phan - Team Member
Marie Pohida - Team Member
Todd Hilsmeier - Team Member
Edward Fuller - Team Member
Ruth Reyes - Project Manager

Logistics:

The audit will be conducted May 19 - 23, 2011, at the office of MNES located in Arlington, VA. The audit is scheduled to begin at 8:30 a.m. The review selected topics are arranged into three days as follows:

- Thursday, May 19, 2011 - Discuss the DCD, Revision 3 and the PRA, Revision 3 impacts of the audit scope areas. Level 2 PRA and Severe Accident Assessment.

- Friday, May 20, 2011 - Low Power / Shutdown PRA.

- Monday, May 23, 2011 - Internal Fire and Internal Flood PRAs.

Special Requests:

Appropriate handling and protection of proprietary information shall be acknowledged and observed throughout the audit.

Deliverables:

The NRC staff will conduct the audit starting on May 19, 2011. The NRC staff may request an ad-hoc extension of the audit if findings during the ongoing audit reveal the need for additional time. Such an extension will be requested before the audit is adjourned on May 23, 2011, by the NRC staff responsible for the audit. An audit report will be generated after the 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 issuance of further RAIs (if necessary) for the licensing review of the US-APWR DC Application, Chapter 19 and Section 17.4 and in the preparation of the NRC staff's safety evaluation report.

References:

1. US-APWR DCD Revision 3

2. US-APWR PRA Revision 2 and draft Revision 3

NRC NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants.”

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References:

1. US-APWR DCD Revision 3

2. US-APWR PRA Revision 2 and draft Revision 3

NRC NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

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OFFICE	DNRL/NMIP: PM	DNRL/NMIP: LA	DNRL/NMIP: PM	DNRL/NMIP: BC
NAME	RReyes	CSmith*	JCiocco	HHamzehee
DATE	05/16/2011	05/13/2011	05/16/2011	05/16/2011

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DC Mitsubishi - US APWR Mailing List (Revised 04/19/2011)

cc:

Ms. Michele Boyd
Legislative Director
Energy Program
Public Citizens Critical Mass Energy
and Environmental Program
215 Pennsylvania Avenue, SE
Washington, DC 20003

Atsushi Kumaki
Mitsubishi Heavy Industries, Ltd.
APWR Promoting Department
Wadasaki-cho- 1-1-1, Hyogo-ku
Kobe 652-8585 JAPAN

Dr. Masanori Onozuka
Mitsubishi Nuclear Energy Systems, Inc.
1001 19th Street North, Suite 710
Arlington, VA 22201-5426

Dr. C. Keith Paulson
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146

Mr. Tom Sliva
7207 IBM Drive
Charlotte, NC 28262

Mr. Robert E. Sweeney
IBEX ESI
4641 Montgomery Avenue
Suite 350
Bethesda, MD 20814

Mr. Ed Wallace
General Manager - Projects
PBMR Pty LTD
P. O. Box 9396
Centurion 0046
Republic of South Africa

Mr. Gary Wright, Director
Division of Nuclear Facility Safety
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, IL 62704

DC Mitsubishi - US APWR Mailing List

Email

APH@NEI.org (Adrian Heymer)
atsushi_kumaki@mhi.co.jp (Atsushi Kumaki)
awc@nei.org (Anne W. Cottingham)
bgattoni@roe.com (William (Bill) Gattoni))
BrinkmCB@westinghouse.com (Charles Brinkman)
ck_paulson@mnes-us.com (C Keith Paulson)
ckpaulson@aol.com (C.K. Paulson)
CumminWE@Westinghouse.com (Edward W. Cummins)
cwaltman@roe.com (C. Waltman)
david.hinds@ge.com (David Hinds)
david.lewis@pillsburylaw.com (David Lewis)
DeLaBarreR@state.gov (R. DeLaBarre)
Derlinda.Bailey@chguernsey.com (Derinda Bailey)
donald.woodlan@luminant.com (Donald Woodlan)
eliza.seedcoalition@gmail.com (Elza Brown)
erg-xl@cox.net (Eddie R. Grant)
f.tanaka@mnes-us.com
gcesare@enercon.com (Guy Cesare)
james.beard@gene.ge.com (James Beard)
jerald.head@ge.com (Jerald G. Head)
jim.riccio@wdc.greenpeace.org (James Riccio)
Joseph_Hegner@dom.com (Joseph Hegner)
jrund@morganlewis.com (Jonathan Rund)
KSutton@morganlewis.com (Kathryn M. Sutton)
kwaugh@impact-net.org (Kenneth O. Waugh)
lchandler@morganlewis.com (Lawrence J. Chandler)
lon.burnam@house.state.tx.us (Lon Burnam)
m.goto@mnes_us.com
Marc.Brooks@dhs.gov (Marc Brooks)
maria.webb@pillsburylaw.com (Maria Webb)
mark.beaumont@wsms.com (Mark Beaumont)
Mark.Crisp@chguernsey.com (Mark Crisp)
mark.g.giles@dom.com (Mark Giles)
mark.vannoy@mnes-us.com
masahiko_kaneda@mhi.co.jp (Masahiko Kaneda)
masanori_onozuka@mnes-us.com (Masanori Onozuka)
masato.oba@mnes-us.com
masayuki_kambara@mhi.co.jp (Masayuki Kambara)
matias.travieso-diaz@pillsburylaw.com (Matias Travieso-Diaz)
mayorsouthern@granbury.org (Mayor David Southern)
media@nei.org (Scott Peterson)
mike_moran@fpl.com (Mike Moran)
MSF@nei.org (Marvin Fertel)
mutsumi_ishida@mnes-us.com (Mutsumi Ishida)

DC Mitsubishi - US APWR Mailing List

mwetterhahn@winston.com (M. Wetterhahn)
nan_sirirat@mnes-us.com (Sirirat Mongkolkam)
nirsnet@nirs.org (Michael Mariotte)
Nuclaw@mindspring.com (Robert Temple)
patriciaL.campbell@ge.com (Patricia L. Campbell)
paul.gaukler@pillsburylaw.com (Paul Gaukler)
Paul@beyondnuclear.org (Paul Gunter)
pbessette@morganlewis.com (Paul Bessette)
plarimore@talisman-intl.com (Patty Larimore)
pshastings@duke-energy.com (Peter Hastings)
RJB@NEI.org (Russell Bell)
ryan_sprengel@mnes-us.com (Ryan Sprengel)
sabinski@suddenlink.net (Steve A. Bennett)
sandra.sloan@areva.com (Sandra Sloan)
satoshi_hanada@mnes-us.com (Satoshi Hanada)
satoshi_watanabe@mnes-us.com (Satoshi Watanabe)
sfrantz@morganlewis.com (Stephen P. Frantz)
shinji_kawanago@mnes-us.com (Shinji Kawanago)
stephan.moen@ge.com (Stephan Moen)
steven.hucik@ge.com (Steven Hucik)
strambgb@westinghouse.com (George Stramback)
Tansel.Selekler@nuclear.energy.gov (Tansel Selekler)
tgilder1@luminant.com (Tim Gilder)
tmatthews@morganlewis.com (T. Matthews)
tom.miller@hq.doe.gov (Tom Miller)
trsmith@winston.com (Tyson Smith)
Vanessa.quinn@dhs.gov (Vanessa Quinn)
vijukrp@westinghouse.com (Ronald P. Vijuk)
Wanda.K.Marshall@dom.com (Wanda K. Marshall)
whorin@winston.com (W. Horin)
yoshiki_ogata@mhi.co.jp (Yoshiki Ogata)