

December 13, 2011

APPLICANT: MITSUBISHI HEAVY INDUSTRIES, LTD.

APPLICATION: UNITED STATES - ADVANCED PRESSURIZED WATER REACTOR DESIGN CERTIFICATION REVIEW

SUBJECT: SUMMARY OF THE OCTOBER 31, 2011, CLOSED MEETING WITH MITSUBISHI HEAVY INDUSTRIES, LTD., TO DISCUSS THE TECHNICAL REPORTS RELATED TO STEEL-CONCRETE MODULES OF THE UNITED STATES - ADVANCED PRESSURIZED WATER REACTOR CONTAINMENT INTERNAL STRUCTURE

On October 31, 2011, a closed meeting was held between the U.S. Nuclear Regulatory Commission (NRC) and Mitsubishi Heavy Industries, Ltd. (MHI) at the NRC offices in Rockville, Maryland. The meeting notice was issued on October 20, 2011, and was documented in the Agencywide Documents Access and Management System (ADAMS) under accession number ML112911449. The notice included the meeting agenda. The purpose of the meeting was to discuss the review of the United States - Advanced Pressurized Water Reactor (US-APWR) Design Certification Document (DCD) Section 3.8. In particular, MHI and NRC staff discussed the technical reports related to steel-concrete (SC) modules of the US-APWR containment internal structure (CIS). Enclosed is the meeting agenda. MHI's presentation contains proprietary information and is not available to the public.

MHI presented a high level summary of the overall plan for the design and verification approach of the US-APWR CIS SC walls and illustrated the relationship of various technical and calculation reports associated with the design of the CIS. The following are the main issues discussed:

- The need to have sufficient test data to demonstrate the adequacy of the analysis and design methodologies. To facilitate the review of the entire test data and to better correlate the tests to the actual US-APWR standard plant design, MHI agreed to provide a table/roadmap which describes the correlation between referenced SC tests in the various MHI submitted technical reports and the actual US-APWR standard plant design
- The staff requested MHI to clarify in the appropriate technical reports that for seismic loading the uncracked and cracked condition for all SC and reinforced concrete (RC) members are analyzed and then the resulting member forces are enveloped. The same approach is also used for the other loads. Then, for each load combination, total member forces are determined separately for the uncracked and cracked conditions. The envelope of these two cases is used for the design of the members. The applicant should also clarify how the effects of cracked concrete will be considered in the finite element model, e.g., the use of a single stiffness and damping value for all finite elements within the SC category and RC type members or the use of an alternate approach.
- The staff informed MHI that for the proposed confirmatory testing, they should submit a detailed test plan (e.g., purpose, scope, test specimen configuration and materials, loading, responses to be measured, etc.), schedule, and location of test facility.

Tests should consider the US APWR CIS design configuration, loading condition, and the effects of cracking.

- To facilitate the staff's ability to assess the adequacy of the testing plan, the staff indicated to MHI that they need to provide a correlation of the existing test SC test database, used as the basis for validating the adequacy of ACI 349 provisions to SC, to the actual US-APWR standard plant.
- Technical alignment on the overstrength connection design methodology has not been reached. MHI is committed to providing: (1) the locations/extent of the connections that will utilize the overstrength connection design approach, and (2) further justification for the overload factors being used. The staff informed MHI that it intends to review the adequacy of the proposed overstrength approach with respect to applicable design code(s).
- The presentation did not cover the confirmatory plan for verification of seismic performance of the CIS structure (Tasks 3 & 4 described in MHI technical report MUAP-11013). MHI agreed to propose a date to discuss the confirmatory plan to verify the seismic performance of the CIS structure.
- The staff indicated to MHI that they should address the combination of stresses in the steel face plates which are subjected to various member forces from multiple directions (e.g., membrane plus bending in two perpendicular directions and at discontinuities the additional effects due to shear).

MHI and NRC staff agreed on the following follow-up actions:

- MHI – to provide a meeting date and agenda for the proposed meeting to discuss the confirmatory plan to verify the seismic performance of the CIS structure.
- MHI – to provide a schedule for the development of the updated design loads and implementation used in the design of the CIS and its connections.
- MHI – to document the justification for using composite damping values being used in the design of the CIS.
- NRC – to provide feedback on the use overstrength connection approach.

A list of attendees is provided as Enclosure 1.

Please direct any inquiries to me at 301-415-6256, or via e-mail to [Dennis.Galvin@nrc.gov](mailto:Dennis.Galvin@nrc.gov).

*/RA/*

Dennis Galvin, Project Manager  
US-APWR Projects Branch  
Division of New Reactor Licensing  
Office of New Reactors

Please direct any inquiries to me at 301-415-6256, or via e-mail to [Dennis.Galvin@nrc.gov](mailto:Dennis.Galvin@nrc.gov).

*/RA/*

Dennis Galvin, Project Manager  
US-APWR Projects Branch  
Division of New Reactor Licensing  
Office of New Reactors

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OFFICE	DNRL/NMIP: PM	DNRL/NMIP: LA	DNRL/NMIP: PM	DNRL/NMIP: PM (signed)
NAME	DGalvin	CSmith(RYB for)	JCiocco	DGalvin
DATE	12/13/11	12/ 8/11	12/13/11	12/13/11

**OFFICIAL RECORD COPY**

List of Attendees

Meeting with Mitsubishi Heavy Industries, Ltd. (MHI) to Discuss the Technical Reports Related to Steel-Concrete Modules of the United States - Advanced Pressurized Water Reactor Containment Internal Structure held on October 31, 2011

<u>NAME</u>	<u>AGENCY/AFFILIATION</u>
Ryo Fugimoto	MHI
Hiroyuki Fuyama	MHI
Shigeya Kumagai	MHI / Obayashi
Kazunori Akiyama	MHI / Obayashi
Bruce Knobloch	MHI / Marathon Consulting Group
Keith Paulson	Mitsubishi Nuclear Energy Systems
Takanori Ogata	Mitsubishi Nuclear Energy Systems
John Regan	Mitsubishi Nuclear Energy Systems
William McConaghy	Mitsubishi Nuclear Energy Systems
Masanori Onozuka	Mitsubishi Nuclear Energy Systems
Erin Wisler	Mitsubishi Nuclear Energy Systems
Branko Galunic	URS
Derek Winkler	URS
Eric Brodis	URS
Carl Baylor	URS
Matthew Van Liew	URS
Robert Kennedy	Structural Mechanics Consulting
Amit Varma	Purdue University
Curt Angstadt	Luminant / Enercon
Sam Hobbs	Luminant / Enercon
William Gallagher	Dominion
Jaspal Saini	Dominion / Bechtel
Rich Baker	Dominion / Bechtel
Dennis Galvin	Nuclear Regulatory Commission
Hossein Hamzehee	Nuclear Regulatory Commission
Mohammed Shams	Nuclear Regulatory Commission
Vaughn Thomas	Nuclear Regulatory Commission
Pravin Patel	Nuclear Regulatory Commission
Bret Tegeler	Nuclear Regulatory Commission
Joseph Braverman	Brookhaven National Laboratory
Xing Wei	Brookhaven National Laboratory

Enclosure

DC Mitsubishi - US APWR Mailing List  
cc:

(Revised 12/07/2011)

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. Tony Robinson  
AREVA NP, Inc.  
3315 Old Forest Road  
Lynchburg, VA 24501

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

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

acpasswater@aol.com (Al Passwater)  
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)  
ewallace@nuscalepower.com (Ed Wallace)  
f.tanaka@mnes-us.com  
gcesare@enercon.com (Guy Cesare)  
hiroki\_nishio@mhi.co.jp (Hiroki Nishio)  
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)  
jrappe@nuscalepower.com (Jodi Rappe)  
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.a.giles@dom.com (Mark Giles)  
mark.beaumont@wsms.com (Mark Beaumont)  
Mark.Crisp@chguernsey.com (Mark Crisp)  
masahiko\_kaneda@mhi.co.jp (Masahiko Kaneda)  
masanori\_onozuka@mnes-us.com (Masanori Onozuka)  
masayuki\_kambara@mhi.co.jp (Masayuki Kambara)  
matias.travieso-diaz@pillsburylaw.com (Matias Travieso-Diaz)  
media@nei.org (Scott Peterson)  
mike\_moran@fpl.com (Mike Moran)  
MSF@nei.org (Marvin Fertel)

## DC Mitsubishi - US APWR Mailing List

mutsumi\_ishida@mnes-us.com (Mutsumi Ishida)  
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)  
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)