Summary Report

ANSN SATG - IAEA ANSN Consultancy Meeting on peer review for finalization of the draft technical document on Fluid Structure Interaction Evaluation Method to hold jointly with ASME PVP conference in 2014

Anaheim, USA, 21 - 24 July 2014

PARTICIPATING ORGANIZATIONS

Japan

Japan Atomic Energy Agency (JAEA)
Central Research Institute of Electric Power Industry (CRIEPI)
Hitachi Ltd. Company
The University of Tokyo
Osaka Sangyo University

Korea, Republic of

Pusan National University

United Kingdom
University of Manchester

American Society of Mechanical Engineers FSI Committee

BACKGROUND

Fluid-structure interaction (FSI) is the interaction of some movable or deformable structure with an internal or surrounding fluid flow so that fluid-structure interactions can be oscillatory. In oscillatory interactions, the strain induced in the solid structure causes it to move such that the source of strain is reduced, and the structure returns to its former state for the process to repeat. Therefore, fluid-structure interaction is being considered in the design of marine platforms, nuclear power plants, hydroelectric dams, and other structures so that significant efforts have gone into developing modelling and simulation approaches over the past decades.

In nuclear power plants, fluid structure interactions occurring inevitably in operating reactor component systems can cause excessive force or stress to the structures resulting in mechanical damages that may eventually threaten the structural integrity of components. Therefore, nuclear plants should be designed to be highly secure and capable to withstand a wide range of internal and external extreme accident loads, such as earthquakes, tsunamis, etc., whose intensity exceed the design level one. After Fukushima Daiichi accident, the seismic behaviour of system, structure and components in a nuclear power plant is of getting importance because the reactor behaviour is influenced by the fluid-structure interaction and sloshing phenomenon (liquid waves can form and impact on reactor vessel and internals walls).

In this regards, the development of technical document on FSI evaluation methods has initiated since 2012 and a draft technical document has developed. In order to disseminate for verification of its applicability, a peer review of this document was recognized so that a consultancy meeting jointly with the 2014 ASME PVP conference was proposed in the last consultancy meeting on July 2013.

OBJECTIVES

The objective of this consultancy meeting to be held jointly with a special technical session, FSI-9, IAEA Activities on Fluid Structural Interaction for Nuclear Components of ASME PVP conference is as followings:

1. To develop technical guidance on safety analysis methods can be used to predict and analysis the FSI phenomena.
2. To disseminate the draft technical document for verification of its applicability in the ASME PVP conference.
3. To finalize the draft technical document with comments from ASME PVP conference and consultancy meeting.

To develop TECDOC which can be used as the guidance on safety analysis methods and tools to evaluate FSI phenomena, the following scopes will be considered;

- Definition of fluid structure interaction and related concepts
- State-of-the-art standard methodologies of fluid structure interaction assessment
- Fluid structure interaction evaluation methods
- The guidance to predict and analysis the FSI phenomena

WORK DONE

ANSN SATG Consultancy Meeting had held jointly with the ASME Pressure Vessels & Piping Conference from 20 to 24 July in Anaheim USA. The Conference is known to be the outstanding international technical forum for participants to further their knowledge-base through exposure to diverse engineering topics and dissemination of cutting-edge technology related to pressure vessel and piping technologies for the power and process industries. This year, the Conference Technical Program contains approximately 750 technical papers and presentations organized into approximately 190 technical and panel discussion sessions, three technical tutorials, two special tutorials, and two workshops.

The Conference opens on Monday, July 21 and Representatives of the American Society of Mechanical Engineers welcome the attendees. Following all technical sessions were held during four days. (See attached PVP 2014 sessions and meetings).

At the second days on 22 July, SESSION 2.3I (FSI-9-2) on IAEA Activities on Fluid Structure Interaction for Nuclear Power Plant was held and had presented following four papers:

- PVP2014-29109: An Overview Of IAEA Technical Guidelines on Fluid-Structure Interaction (draft), R. A. Ainsworth, Manchester University, Manchester, United Kingdom; M. Kim, IAEA, Vienna, Austria; P. Hughes, International Atomic Energy Agency, Vienna, Austria
- PVP2014-28389: Design and Maintenance in an IAEA Technical Document on Fluid-Structure Interaction (draft), F. Inada, Central Research Institute of Electric Power Industry, Komaeshi, Tokyo, Japan; T. Nakamura, Osaka Sangyo University, Daito, Osaka, Japan; T. Nishihara, CRIEPI, Abiko, Chiba, Japan; S. Kaneko, The University of Tokyo, Tokyo, Japan; M. Kim, IAEA, Vienna, Austria
- PVP2014-28476: Nuclear Power Plant Issues in IAEA Technical Guidelines on Fluid-Structure Interactions (draft), S. Takahashi, Hitachi, Ltd., Hitachi Research Laboratory, Hitachi, Japan; K. Hasegawa, Consultant, Hitachi naka-shi, Japan; T. Nakamura, Osaka Sangyo University, Daito, Osaka, Japan
- PVP2014-28916: An Overview of Numerical Method for Fluid Structure Interaction, M. Kim, IAEA, Vienna, Austria; J. H. Jeong, Pusan National University, Pusan, Korea (Republic); P. Hughes, International Atomic Energy Agency, Vienna, Austria

The Consultancy Meeting was held in room RB E+F, Hyatt Regency Orange County on 23 July 2014. In advance of the meeting, Man Kim made a presentation describing the structure of IAEA Safety Standards, indicating where the FSI technical document ~~guidelines~~ would fit into the general framework of IAEA documentation. The status and process for drafting technical document was discussed. It was also noted that an independent peer review to the draft document is required for community. ASME FSI Committee, where some people attend this meeting as their personal stand point, concurred with IAEA's direction and goal. In addition, both sides indicated that a technical workshop should be organised to disseminate the contents of the draft document.

Regarding the independent peer review, it was principally agreed by attendees at the meeting and the actions and timescales for peer review of the draft document were discussed. Agreed actions following this discussion were;

- IAEA will send an official letter of review request to ASME FSI committee
- ASME FSI committee will identify experts who will be being dedicated for this peer review and formulate a technical group (hereinafter called ASME FSI team), based on the agreement that this document is written as the state of arts and that this document is not a mandatory design guideline.
- ASME FSI team will deliver latest references to IAEA team until end of September 2014
- IAEA team will update the draft document and send it to ASME FSI team
- ASME FSI team will deliver a first review comments and inputs to IAEA team until end of January 2015, and the draft document can be reviewed with the other people besides both team , if necessary.
- The reviewers would be included as contributors in the document.
- IAEA will provide the other IAEA technical documents to the reviewers as a reference.
- IAEA will send a provisional plan of Technical Meeting being held jointly with ASME workshop to ASME FSI committee. ASME FSI committee proposed to hold this activity concurrently with ASME 2015 PVP Conference on 19-23 July in Boston USA
- In advance of the Technical Meeting (IAEA) Jointly with Workshop (ASME FSI committee), IAEA team will circulate a final draft ~~guidelines~~ to the ASME FSI team no later than a month.

As described above, IAEA team will review tentatively committed actions in more detail whether IAEA team can be approved in preparation related to IAEA activities (i.e. budget, time availability, etc.). In this regard, IAEA team will keep in touch with ASME FSI team continuously.

WORKSHOP ACHIEVEMENTS / RECOMMENDATIONS

Session FSI-9.2 on IAEA Activities on FSI (Flow Structural Interaction) is unique and remarkable for sharing information with ASME members and all attendees. Four papers were presented by IAEA and IAEA collaborators for their activities on development of technical guidelines on FSI evaluation. Audience was interested in contents of the draft document on FSI focused on applicability, progress status and publication date, etc. for community to use this guideline. In the session room, there were many questions-and-answers for sharing up-to-technology and experiences. After closing the session, there was a consultancy meeting between some members of FSI Technical Committee and IAEA team to discuss on future cooperation between ASME FSI committee and IAEA. It was a very beneficial and fruitful session not only as a pilot cooperation activity between ASME FSI committee and IAEA, but also will be a corner stone for future cooperation for both ASME PVP committee and IAEA.

In the Consultancy Meeting, it was also noted that an independent peer review to the draft document is required for community. ASME FSI Committee, where some people attend this meeting as their personal stand point, concurred with IAEA's direction and goal. In addition, both sides indicated that a technical workshop should be organised to disseminate the contents of the draft document guidelines. Regarding the independent peer review, it was principally agreed by attendees at the meeting and the actions and timescales for peer review of the draft document were discussed. ASME FSI committee proposed to hold this activity concurrently with ASME 2015 PVP Conference on 19-23 July in Boston USA. In this regard, IAEA team will review tentatively committed actions in more detail whether

IAEA team can be approved in preparation related to IAEA activities (i.e. budget, time availability, etc.). In this regard, IAEA team will keep in touch with ASME FSI team continuously.

During the 2014 ASME PVP Conference, all activities for Session FSI-9.2 on IAEA Activities on FSI and the consultancy meeting between IAEA team and ASME FSI committee were successfully completed without any technical, logistical, administrative or other problem encountered. In this regards, IAEA appreciated hospitality and logistical support provided by host organization, ASME.

ATTACHMENT:

Attachment 1: Final 2014 ASME PVP Conference
Attachment 2: Agenda of Consultancy Meeting
Attachment 3: List of Participants
Attachment 4: Meeting Note between ASME FSI Committee and IAEA Team

ATTACHMENT 1:

Final 2014 ASME PVP Conference

PVP 2014 Program Layout

	Sunday July 20, 2014	Monday July 21, 2014	Tuesday July 22, 2014	Wednesday July 23, 2014	Thursday July 24, 2014
7:30 am 8:15 am	Arrival Registration Opens (8:00 am – 6:00 pm)	Authors' Breakfast/Briefing Registration Open (7:30 am – 4:00 pm)	Authors' Breakfast/Briefing Registration Open (7:30 am – 4:00 pm)	Authors' Breakfast/Briefing Registration Open (7:30 am – noon)	Authors' Breakfast/Briefing Registration Open (7:30 am – 3:00 pm)
8:30 am 10:15 am	Technical Workshop (9:00 am – 11:30 am)	**Block 1.1** Technical Sessions NDE Demo	**Block 2.1** TPR & Session Developer Training Technical Sessions Software Demo	**Block 3.1** Technical Sessions	**Block 4.1** Technical Sessions
10:30 am 12:15 pm	Open	**Block 1.2** Plenary Session NDE Demo	**Block 2.2** Technical Sessions Software Demo	**Block 3.2** Technical Sessions	**Block 4.2** Technical Sessions
12:15 pm 1:45 pm	Open	Lunch Technical Committee Meetings	Lunch Technical Committee Meetings	Honors & Awards Luncheon (12:30 pm – 2:15 pm)	Lunch
2:00 pm 3:45 pm	Special Tutorial (1:00 pm – 3:30 pm)	**Block 1.3** Technical Sessions Technical Tutorial NDE Demo	**Block 2.3** Technical Sessions Technical Tutorial Software Demo	**Block 3.3** Open	**Block 4.3** Technical Sessions
4:00 pm 5:45 pm	Special Tutorial (4:00 pm – 6:00 pm)	**Block 1.4** Technical Sessions Technical Tutorial NDE Demo	**Block 2.4** Technical Session Technical Tutorial Software Demo	**Block 3.4** Open	**Block 4.4** Technical Sessions Conference Evaluation
Evening	Open	Conference-Wide Reception (6:15 pm – 8:00 pm)	Open	Conference Social Event: An Evening at Disney (4:00 pm – 11:00 pm)	Open

ASME PVP 2014 CONFERENCE
SESSIONS AND MEETINGS AT A GLANCE

Block	Sunday July 20	Monday July 21					Tuesday July 22					Wednesday July 23					Thursday July 24					
		1.1 8:30-10:15	1.2	Lunch	1.3 2:00-3:45	1.4 4:00-5:45	2.1 8:30-10:15	2.2 10:30-12:15	Lunch	2.3 2:00-3:45	2.4 4:00-5:45	3.1 8:30-10:15	3.2 10:30-12:15	Lunch	3.3 2:00-3:45	3.4 4:00-5:45	4.1 8:30-10:15	4.2 10:30-12:15	Lunch	4.3 2:00-3:45	4.4 4:00-5:45	
A		MF-15-1	PLENARY SESSION Grand Ballroom		MF-15-2	MF-16-1	MF-16-2	DA-6-1		MF-23-1	SE-13-2	CT-10-1	MF-2-1	HONORS LUNCH Grand Ballroom	O p e n	O p e n	MF-2-2	MF-2-3		MF-2-4	MF-2-5	Terrace E+F (ST)
B		SPC-2-1			SPC-1-1	SPC-1-2	SPC-1-3	SPC-1-4		SPC-2-2	SPC-2-3	SPC-2-4	CS-21-1				-	-		-	-	RB-A (ST)[1]
C		CS-8-1			CS-8-2	CS-2-1	CS-3-1	CS-3-2		CS-3-3	CS-3-4	DA-3-1	DA-3-2				DA-3-3	-		-	-	Terrace A+B (ST)
D		FSI-4-1			FSI-3-18	FSI-3-19	CS-1-1	CS-1-2		CS-1-3	CS-1-4	CS-4-1	CS-27-1				CS-10-1	CS-10-2		-	-	Regal (ST)
E		MF-4-1			MF-4-2	MF-4-3	MF-4-4	MF-4-5		MF-4-6	MF-4-7	MF-4-8	-				SE-6-1	SE-6-2		SE-6-3	SE-5-1	Imperial (ST)
F		MF-5-1			MF-5-2	MF-5-3	SE-4-1	SE-4-2		MF-7-1	MF-7-2	CS-28-1	CS-28-2				SE-2-1	SE-7-1		SE-13-3	-	Terrace C+D (ST)
G		DA-1-1			DA-1-2	DA-1-3	DA-1-4	CS-12-1		CS-16-1	CS-16-2	DA-4-1	DA-4-2				CT-14-1	CT-12-1		FSI-2-1	-	GB-E (NT)[2]
H		HT-1-1			HT-3-1	HT-3-2	DA-12-1	MF-12-1		HT-2-1	CS-6-1	HT-4-1	HT-5-1				MF-3-1	MF-3-2		MF-3-3	MF-3-4	GB-G (NT)[3]
I		DA-13-2			DA-13-1	DA-13-3	MF-10-1	MF-10-2		FSI-9-2	FSI-5-1	SE-6-5	SE-6-6				CS-11-1	CS-11-2		CS-11-4	CS-11-5	RB-E+F (ST)[4]
J		CS-19-1			MF-14-2	MF-14-3	DA-2-1	DA-2-2		DA-2-5	DA-2-4	DA-2-3	-				MF-18-1	SE-10-1		-	-	Garden 1 (NT)
K		OAC-6-1			OAC-6-2	OAC-6-3	OAC-1-1	OAC-1-2		OAC-3-1	OAC-5-1	OAC-8-1	MF-17-1				FSI-3-10	FSI-3-11		FSI-3-12	FSI-3-13	Garden 2 (NT)
L		CT-2-1			CT-4-1	CT-5-1	CT-6-1	CT-9-1		DA-10-4	DA-10-5	DA-10-1	DA-10-3				OAC-4-1	OAC-4-2		DA-17-1	DA-17-2	RB-D (ST)[5]
M		SE-1-1			SE-13-1	SE-3-1	CS-9-1	CS-14-1		CS-17-1	DA-8-1	DA-8-2	DA-8-3				MF-6-1	MF-6-2		MF-11-1	MF-11-2	RB-C (ST)[6]
N		FSI-3-1			FSI-3-2	FSI-3-3	FSI-3-4	FSI-3-5		FSI-3-6	FSI-3-7	FSI-3-8	FSI-3-9				FSI-3-14	FSI-3-15		FSI-3-16	FSI-3-17	GB-F (NT)[7]
O		MF-19-1			MF-19-2	MF-19-4	MF-19-5	HT-5-2		CS-13-1	CS-13-2	DA-7-1	DA-7-2				NDE-1-1	NDE-4-1		NDE-5-1	-	RB-B (ST)[8]
Q	Wkshp / Spec Tut I	-		C&S	Tech Tutorial I		Conf Org Training	-	M&F	Tech Tutorial II		-	-				-	-		-	-	Pacific (NT)
S		NDE Forum					Software Forum															Royal Ballroom Foyer (ST)

DIVISION COMMITTEE MEETINGS AND ROOMS

TC1	Executive Cmte./Sen			FSI	Int. Coord.		Prof. Dvlpmnt	Communi-cations	SE	Honors	PVP15 Program	JPVT Editors		NDE Division		Executive Committee						Commodore Boardroom (ST)
TC2				OAC					HPT			Reserved		TG-ILV	TG-ILV	SG-HPV	SG-HPV		SG-HPV	SG-HPV		Salon VII+VIII (NT)
TC3				D&A					CT/BJ													Harbor (NT)
TC4																		General Committee		Conf Wrap Up		Grand Ballrm A (NT)
TC5		Audio-Visual Practice Room					Audio-Visual Practice Room					Audio-Visual Practice Room				Audio-Visual Practice Room						Granada (ST)
TC6	Pub. Sales	ASME Publication Sales					ASME Publication Sales					ASME Publication Sales				ASME Publication Sales						Royal Ballroom Foyer (ST)
TC7	HQ Room	ASME Office/HQ Room					ASME Office/HQ Room					ASME Office/HQ Room				ASME Office/HQ Room						Barcelona (ST)
TC8		Guest Hospitality					Guest Hospitality					Guest Hospitality				Guest Hospitality						Garden 3 (NT)

CS — CODES & STANDARDS	SE — SEISMIC ENGINEERING	FSI — FLUID-STRUCTURE INTERACTION	CT — COMPUTER TECHNOLOGY & BOLTED JOINTS	DA — DESIGN & ANALYSIS
TUTORIALS	NDE — NON-DESTRUCTIVE EXAMINATION	OAC — OPERATIONS, APPS & COMPONENTS	SPC — STUDENT PAPER COMPETITION & SYMPOSIUM	HT — HIGH PRESSURE TECHNOLOGY
	PVPD COMMITTEE	TECHNICAL COMMITTEE	ASME BPV COMMITTEE	MF — MATERIALS & FABRICATION

Room Notes:

1. Royal Ballroom - A South Tower
2. Grand Ballroom - E North Tower
3. Grand Ballroom - G North Tower
4. Royal Ballroom - E+F South Tower
5. Royal Ballroom - D South Tower
6. Royal Ballroom - C South Tower
7. Grand Ballroom - F North Tower
8. Royal Ballroom - B South Tower

Badge required for all events.
Plenary Lecture: Monday (10:30 am–12:15 pm) Grand Ballroom A+B+C+D (North Tower)
Conference-Wide Reception: Monday (6:15 pm–8:00 pm) Grand Ballroom A+B+C+D (North Tower) (All registrants and spouses invited — Badge only)
Honors Luncheon: Wednesday (12:00 pm–2:15 pm) Grand Ballroom A+B+C+D (North Tower) (Ticket required)
Author's Breakfast/Briefing: Monday - Thursday (7:30 am–8:15 am)Grand Ballroom A+B+C+D (North Tower)
Guest Breakfast: Monday-Thursday (7:30 am–10:30 am) Garden Rm 3 (South Tower)

ATTACHMENT 2:

ANSN SATG - IAEA ANSN Consultancy Meeting on peer review for finalization of the draft technical document on Fluid Structure Interaction Evaluation Method to hold jointly with ASME PVP conference in 2014

21 – 24 July, 2014
Anaheim, USA

AGENDA

Day 1 (Monday, 21 July 2014)		
Time	**Name of presentation / activity**	**Presented by**
08:30-12:00	1. Attending ASME PVP FSI Technical Session	All participants
	Break	
14:00-18:00	2. Attending ASME PVP FSI Technical Session	All participants

Day 2 (Tuesday, 22 July 2014)		
Time	**Name of presentation / activity**	**Presented by**
08:30-12:00	3. Attending ASME PVP FSI Technical Session	
	Break	
14:00-16:00	4. Session FSI-9.2 on IAEA Activities on FSI • PVP2014-29109: An Overview Of IAEA Technical Guidelines on Fluid-Structure Interaction (draft), M. Kim, IAEA • PVP2014-28389: Design and Maintenance in an IAEA Technical Document on Fluid-Structure Interaction (draft), F. Inada • PVP2014-28476: Nuclear Power Plant Issues in IAEA Technical Guidelines on Fluid-Structure Interactions (draft), S. Takahashi • PVP2014-28916: An Overview of Numerical Method for Fluid Structure Interaction, M. Kim, IAEA • Question and Answer	Chair: M.Kim (IAEA)
16:00-17:00	5. IAEA Team discussion	All participants

Day 3 - 4 (Wednesday, 23 July 2014)		
Time	**Name of presentation / activity**	**Presented by**
08:30-12:00	6. Attending ASME PVP FSI Technical Session	All participants
	Break	
14:00-17:00	7. Consultancy Meeting between IAEA Team and ASME FSI Committee • General framework of IAEA documentation • The status and process for drafting technical document • Technical workshop for dissemination of the draft document • Independent peer review of the draft document	All participants

Day 4 (Thursday, 24 July 2014)		
Time	**Name of presentation / activity**	**Presented by**
08:30-12:00	7. Attending ASME PVP FSI Technical Session	All participants
	Break	
14:00	8. Adjourn and Closure	All participants

ATTACHMENT 3:

List of Participants

Tentative ASME FSI Committee Team

Dr Christina Giannopapa,
European Space Agency (ESA)

Dr David S. Weaver, McMaster University, Canada

Dr Pierre Moussou, EdF R&D, France

Dr Victor P. Janzen, AECL, Canada

Prof.M. Pettigrew, Ecole Polytechnique Montreal, Canada

Prof.K.Inaba, Technical Institute of Tokyo, Japan

IAEA Team

Prof. Shigehiko Kaneko, The University of Tokyo, Japan

Prof. Tomomichi Nakamura, Osaka Sangyo University, Japan

Dr Kunio Hasegawa, JAEA, Japan

Dr Fumio Inada, CRIEPI Japan

Dr Shiro Takahashi, Hitachi Japan

Dr Man Kim, NSNI, IAEA

ATTACHMENT 4:

Meeting Note between ASME FSI Committee and IAEA Team

on

Peer Review of IAEA draft technical document ~~guidelines~~ on Fluid Structure Interaction (FSI)

23 July, 2014, Anaheim USA

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The status and process for drafting technical document was discussed. It was also noted that an independent peer review to the draft document is required–for community. ASME FSI Committee, where some people attend this meeting as their personal stand point, concurred with IAEA's direction and goal. In addition, both sides indicated that a technical workshop should be organized to disseminate the contents of the draft document.

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This project is conducted by the IAEA, with funding by the European Union