UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

August 25, 2009

MEMORANDUM TO: ACRS Members

FROM: Neil Coleman, Senior Staff Scientist ***/RA/***
Reactor Safety Branch B, ACRS

SUBJECT: CERTIFICATION OF THE MINUTES OF THE US-APWR SUBCOMMITTEE MEETING ON MAY 21, 2009

The minutes for the subject meeting were certified on August 25, 2009. Along with the transcripts and presentation materials, this is the official record of the proceedings of that meeting. A copy of the certified minutes is attached, representing the **open** (public) sessions. Portions of the subcommittee meeting were closed for discussion of proprietary material.

Enclosure : As stated

cc w Enclosure : E. Hackett
C. Santos
A. Dias
S. Duraiswamy
N. Mitchell-Funderburk

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MEMORANDUM TO: Neil Coleman, Senior Staff Scientist
Reactor Safety Branch B - ACRS

FROM: O. Maynard, Chairman, US-APWR Subcommittee

SUBJECT: THE MINUTES OF THE MEETING OF THE US-APWR SUBCOMMITTEE ON MAY 21, 2009, IN ROCKVILLE, MD

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting are an accurate record of the proceedings for that meeting. These minutes are for the open sessions of this meeting.

/RA/ 8/25/209
O. Maynard Date
US-APWR Subcommittee Chairman

Certified by: Otto Maynard Issued: 08/25/2009
Certified: 8/25/2009

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
US-APWR SUBCOMMITTEE MEETING MINUTES
MAY 21, 2009
ROCKVILLE, MD
(MEETING MINUTES FOR OPEN SESSIONS)

Introduction

The ACRS Subcommittee on US-APWR design review met on May 21, 2009 at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, Rockville, Maryland, at 8:30 a.m., Otto L. Maynard, Chairman, presiding. The Subcommittee met with NRC staff members and representatives of Mitsubishi Heavy Industries (MHI). The purpose of this meeting was for the Subcommittee to hear briefings on MHI topical reports for the U.S. Advanced Pressurized Water Reactor (US-APWR) design.

Attendees (May 21, 2009)

ACRS Members/Staff	**NRC Staff**	**MHI**
Otto Maynard (Chairman)	T. Jackson	M. Takashima
John Stetkar (Member)	R. Beacom	H. Fujimoto
Charles Brown (Member)	N. Otto	S. Kawanago
John Sieber (Member)	N. G. Coleman	S. Niida
Dennis Bley (Member)	D. Spaulding-Yeoman	
Said Abdel-Khalik (Member)	R. Jenkins	**AREVA**
Neil Coleman (DFO)	S. Monarque	A. Lenin
	J. Segala	
MNES	D. Dube	**TEPIC**
R. Sprengel	T. Martinez-Navedo	T. Ishii
K. Paulson	C. Bickett	
M. Onozuka	W. Ward	
S. Hanada	P. Gill	
K. Scarola	N. Saltos	
R. Takanashi		
M. Kambara		

ACRS Members/Staff **NRC Staff** **MHI**

Certified by:
The presentation slides used during the open portions of the meeting are attached to the transcript of this meeting at the following website: http://www.nrc.gov/reading-rm/doc-collections/acrs/tr/subcommittee/. The open-session presentations to the US-APWR Subcommittee are summarized below. There were no requests by members of the public to make written or oral statements.

MAY 21, 2009 - OPENING REMARKS BY CHAIRMAN MAYNARD

Chairman Otto Maynard announced that this is a meeting of the ACRS US-APWR Subcommittee. He named the various members in attendance, and that Neil Coleman of the ACRS staff is the Designated Federal Official for the meeting. He described the purpose of the meeting, which is to review the topical report and the staff's proposed safety evaluation relative to diversity and defense in depth for the US-APWR. It is also an informational brief on the gas turbine generator that is proposed for the US-APWR. Presentations will be made by representatives from NRC's Office of New Reactors and by MHI and their subsidiaries. Carey Bickett of the NRC staff then provided opening remarks and introduced the first speaker, Ngola Otto of the NRC staff.

DISCUSSION OF AGENDA ITEMS

US-APWR Standard Design Certification Gas Turbine Generator Overview.

Mr. Otto's talk was an overview of the gas turbine generator (GTG). The purpose of his talk was to provide the status of the NRC staff review of the US-APWR Design Control Document (DCD) Chapter 8, DCD Sections 9.5.4 – 9.5.8, and the Technical Report titled Qualification and Test Plan of Class 1E Gas Turbine Generator System, MUAP-07024-P (R0), dated December 2007.

With respect to the applicability of the gas turbine generator, MHI proposes to use 4 GTGs as safety-related, class 1E onsite power sources for US-APWR Design. This would be the first use of gas turbines as a safety-related emergency power source in a US plant. Two GTGs would provide alternate AC power sources for the US-APWR Design. Reliability of GTGs is intended to meet the RG 1.155 Station Blackout rule of 0.95 minimum. Also, diversity of GTGs is intended to meet the Commission's guidance in SECY 90-16 for use of GTGs as alternate AC power sources.

Mr. Otto reported on the design review status. Requests for additional information (RAIs) have been issued and responses have been received from MHI. Teleconference meetings were conducted in March 2009 with MHI to address issues. A public meeting was held on April 13, 2009 to address GTG reliability and diversity. Additional RAIs will be issued, and MHI will provide to NRC its diversity strategy based on the public meeting discussion conducted on April 13, 2009. MHI will provide a revised Technical Report (MUAP-07024-P) to address the RAI questions. Also, a GTG review will be included in Chapter 8 and Sections 9.5.4 - 9.5.8 of the Safety Evaluation Report.

Mr. Otto reported that the GTG design review is now being conducted by the NRC staff. MHI plans to conduct a run of 100 tests with no failures per IEEE 387 to demonstrate with 95% assurance that the safety related GTGs will meet 0.95 reliability, per RG 1.155 (Station Blackout).

US-APWR Topical Report MUAP-07006 Defense-in-Depth and Diversity: Safety Evaluation Report (SER)

After Mr. Otto's presentation, Mr. Jeff Ciocco (NRO) gave an overview of the staff's Safety Evaluation Report on Defense-in-Depth and Diversity. The purpose of the talk was to give an overview of the licensing review of the Defense-in-Depth and Diversity (D3) Topical Report. The D3 Topical Report requests approval of the D3 approach for the US-APWR & is referenced in Chapter 7 of Design Control Document. This is one of four topical reports that make up the generic portions of the MHI digital I&C Design. The other three topical reports are:

- Safety I&C System Description and Design Process
- Safety System Digital Platform - MELTAC
- HSI System Description and HFE (Human Factor Engineering) Process

Mr. Ciocco summarized the licensing process to date for the D3 Topical Report. NRC's Acceptance Review was conducted in 2007 and an Acceptance Letter was issued in December of that year. The D3 report was not reviewed for operating reactors. RAI's were issued in May, 2008 and RAI Responses were received in October 2008. An informational briefing was given to the ACRS Subcommittee in November 2008. Then the draft D3 safety evaluation was sent to MHI for a technical adequacy review. After the presentation to this subcommittee meeting the staff will also provide a briefing at the ACRS full-committee meeting in two weeks.

Overview of Safety Evaluation Report for MHI US-APWR Topical Report MUAP-07006-P, Rev. 2, Defense-in-Depth and Diversity

Mr. Royce Beacom (NRO) gave a non-proprietary discussion of this topical report. MHI had originally intended to apply this topical report broadly to an operating fleet, but the NRC staff has indicated that it will be considered specifically for the US-APWR new reactor design. Diversity is provided with respect to both the protection and safety monitoring system (safety) and the plan control and monitoring system (non-safety). Both use the MELTAC platform. The diverse actuation system (DAS) provides a defensive measure to cope with anticipated operational occurrences (AOO) or postulated accidents (PA) concurrent with common cause failure in the protection and safety monitoring system (PSMS).

The staff has identified 11 application specific action items to be evaluated during the design certification reviews. These are briefly summarized below (item 7 combines two action items):

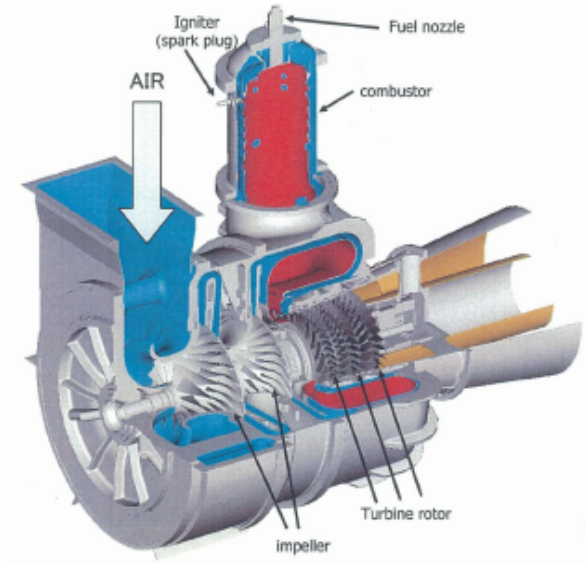
1. demonstrate that the isolation devices are conventional and testable
2. demonstrate the acceptability of all manual actions
3. demonstrate that the power interface (PIF) module is not susceptible to a software common-cause failure (CCF)

4. identify the specific controls and indications for the DHP and address human factors aspects for the DAS and PSMS actuation means
5. provide the final determination of the set points and the response time of the DAS
6. demonstrate that the acceptability of the QA process used for the DAS meets the guidelines of GL 85-06
7. for each AOO and PA in the design basis occurring in conjunction with each single postulated CCF, demonstrate that the plant response using realistic analyses does not result in radiation release exceeding 10% of the 10 CFR Part 100 guidance value or violation of the integrity of the primary coolant pressure boundary
8. address potential partial failures of the PCMS/PSMS and demonstrate an adequate D3 strategy to cope with such failure modes
9. provide an acceptable defense in depth and diversity strategy for a LBLOCA (large-break loss of coolant accident) concurrent with a CCF of the PSMS
10. submit all the information identified in Section 10.0 of the topical report "Future Licensing Submittals"

Overview of Qualification and Test Plan of Class 1E Gas Turbine Generator System, MUAP-07024-P (R0)

Mr. Kawanago of MHI gave a presentation on the gas turbine generator system during the public session. His talk included an introduction to AAC-GTG, the onsite AC power system, the design basis of AAC-GTG, a review of requirements, design concept, and specifications, power supply to onsite buses, diversity, and operation under the SBO.

MHI has selected gas turbine generators for emergency power supply for the US-APWR instead of the commonly used diesel generators. The reasons for this are that the gas turbine is a more compact, simple rotating engine with few components, has less vibration and greater seismic resistance, a water cooling system is not needed, and the GTG should have an even higher level of reliability than the diesel generator. Although a diesel generator can start more quickly than the GTG, the incorporation of an advanced accumulator in the US-APWR allows additional time for GTG start, which would occur in less than 100 seconds. The GTG fuel is diesel oil, and the fuel storage tank for each train has the capability to operate the GTG during seven days of continuous rated capacity. A graphic of the GTG is shown below:



M1A-33Gas Turbine

A summary of the supporting systems for the GTG is provided in the following tables:

System	Diesel Generator System	Gas-Turbine Generator System
Fuel System		Fuel system of GTG is almost similar to DG's. Fuel system is designed based on requirement for safety-related EDG system.
Lubricant System		Amount of consumption of lubricant oil is less than DG's. System is simpler than DG's and system components are fewer than DG's. Lubricant system is used for both engine and generator. Also pre-heat of lubricant oil is not needed.
Starting System	Compressed air rotates the engine directly.	Stating air system of GTG is almost similar to DG's. Air-motors rotate the GTG. Starting system is designed based on requirement for safety-related EDG system.
Cooling System	Water cooling, pre-heat is needed for quick start.	Water cooling is not needed. Self ventilation fan can cool engine and generator package.

System	Diesel Generator System	Gas-Turbine Generator System
Inlet/Exhaust air system		Inlet/Exhaust air system consists of ducts, fan and exhauster. Inlet air is used for both combustion and ventilation. Vented air is discharged, and exhaust is discharged via the exhauster/silencer.
I&C		✓Governor and AVR control is similar to DG's. Monitoring parameters, protection signals are differ from DG's. ✓Control logic of GTG is designed special to GTG, and logic is installed in Class 1E control cabinet.
Auxiliary Power		Auxiliary power is designed almost similar to DG's. ✓Pumps, fans are supplied power from Class 1E ac 480V plant power system. ✓Starting air valves, excitation of generator, control circuits are supplied power from Class 1E dc 125V plant power system.

The start-up signal occurs automatically if the system receives either an ECCS (emergency core cooling system) or an under voltage or degraded voltage signal. Manual starting can be done from the main control room , the GTG room, or from the remote shutdown room. MHI has analyzed available operational data for GTGs and reported the following results from manufacturer records (see table below):

Product	Output(kVA)	Single engine or Twin engine	Fuel Type	Starting system	Failure/Number of starts	Failure/Operation hours
1	2000	Twin	Heavy Oil	Air	0 /251 d	0 /98 hr
2	2000	Twin	Heavy Oil	DC	0 /265 d	0 /75.4 hr
3	2000	Twin	Diesel Oil	DC	0 /100 d	0 /71.3 hr
4	2000	Twin	Kerosene	DC	0 /1053 d	0 /205 hr
5	2500	Twin	Heavy Oil	Air	0 /383 d	0 /1129.8 hr
6	2500	Twin	Heavy Oil	DC	0 /95 d	0 /16.4 hr
7	4000	Twin	Heavy Oil	Air	0 /540 d	0 /982 hr
8	4000	Twin	Heavy Oil	DC	0 /149 d	0 /96.8 hr
9	4000	Twin	Diesel Oil	Air	0 /225 d	0 /156.4 hr
10	4000	Twin	Diesel Oil	DC	0 /105 d	0 /50.8 hr
11	4000	Twin	Kerosene	DC	0 /263 d	0 /109.6 hr

Product	Output(kVA)	Single engine or Twin engine	Fuel Type	Starting system	Failure/Number of starts	Failure/Operation hours
12	4500	Twin	Heavy Oil	Air	0 /327 d	0 /125.1 hr
13	4500	Twin	Heavy Oil	DC	0 /130 d	0 /63.2 hr
14	4500	Twin	Diesel Oil	DC	0 /69 d	0 /80.3 hr
15	4500	Twin	Diesel Oil	DC	0 /147 d	0 /32.1 hr
16	4500	Twin	Kerosene	Air	0 /341 d	0 /455.1 hr
17	4500	Twin	Kerosene	DC	0 /251 d	0 /68.0 hr
18	5000	Twin	Unidentified	DC	0 /48 d	Operation period of those products are short. These are not used for evaluation as conservative.
19	5000	Twin	Unidentified	DC	0 /48 d	
20	6000	Twin	Unidentified	DC	0 /24 d	
21	6000	Twin	Unidentified	DC	0 /24 d	
22	6000	Twin	Unidentified	DC	0 /13 d	
23	6000	Twin	Unidentified	DC	0 /13 d	
24	6000	Twin	Unidentified	DC	0 /12 d	
25	6000	Twin	Unidentified	DC	0 /12 d	
26	6000	Twin	Unidentified	DC	0 /6 d	
27	6000	Twin	Unidentified	DC	0 /1 d	

The presenter reported that reliability estimates for GTGs are based on industry operational experience. Applicable data indicate 1433 demands with 0 failures and 2224 running hours with 0 failures. The failure rate is lower than the mean failure rate of diesel generators, with 95% confidence. Future operating experience will be needed to show that reliability targets can be achieved and maintained over the life of the plant. MHI plans to update the GTG reliability data during operation through surveillance testing.

After the MHI presentation was completed, subcommittee Chairman Maynard stated that the meeting was coming to the end of the open session. He asked if any members of the public who may be present wished to comment. No comments were forthcoming, so the chairman concluded the open portion of the meeting and stated that the remainder of the meeting would be held in closed session. Before recessing for lunch, the chairman informed the NRC staff that he would like to begin the closed session at 12:45 pm.

(Whereupon at 11:46 a.m. the proceeding in the above-entitled matter went off the record to adjourn the open session).