



US-APWR

10th Pre-Application Review Meeting Technical Specifications for Four-Train Safety Systems

September 26, 2007

Mitsubishi Heavy Industries, Ltd.

Meeting Attendees



✓ **Makoto Takashima ***

**Deputy Chief Engineer
Water Reactor Engineering Department**

✓ **Katsunori Kawai ***

**Manager of Safety Integration Group
Safety and Licensing Integration Group
Reactor Safety Engineering Department**

✓ **Etsuro Saji, Ph. D. *** - **Presenter** -

**Engineering Manager
Safety and Licensing Integration Group
Reactor Safety Engineering Department**

*** Nuclear Energy Systems Engineering Center
Mitsubishi Heavy Industries, LTD.**

Objective of the Meeting



- **To introduce MHI's current plans about how to treat the four-train safety systems of US-APWR in Technical Specifications (Considering the NRC comments at the previous PAR meeting on Tech. Specs. held on June 13)**
- **To obtain some feedback from the NRC on MHI's approach**

➤ **MHI needs to clarify:**

- **How the Configuration Risk Management Program (CRMP) will be controlled as part of Tech. Specs. (TS)**
 - In response to MHI's plan to determine completion times by CRMP
- **How Limiting Conditions for Operation (LCOs) are determined**
 - In response to MHI's plan to establish LCOs requiring three trains to be operable for four-train safety systems

- **Safety benefit of four-train systems**
- **LCO requiring three trains operable**
- **Establishing Completion time by applying Risk-Managed Technical Specifications**
- **Summary**

Starting Point



US-APWR

Design concept is based on conventional U.S. PWRs

Four-train safety systems are one of unique design features

- **Its TS basically follow the Standard TS* (STS)**
- **Should reflect safety benefit of the four-train safety systems**

* NUREG-1431, Rev.03, "Standard Technical Specifications Westinghouse Plants"

- **Enhanced redundancy (50%x4)**
 - **Capability beyond single failure criterion**
- **Maximize the benefits of on-line maintenance**
 - **Establish LCO requiring three trains operable**
 - **Establish completion time when one of the three required trains inoperable**



- **Consistent with the deterministic safety basis (10CFR50.36 and General Design Criteria)**
 - Required safety function satisfied with two trains
 - Third train satisfies the single-failure criterion
- **Intend to maintain reliability and availability of all four trains**
 - In accordance with Maintenance Rule (10CFR50.65) to maintain their intended function (monitoring and corrective action)

- **Completion times (CTs) can be established for one of the three required trains inoperable**
 - **Commitment to Configuration Risk Management Program (CRMP)**
 - **30-day limit as a back-stop CT***

* NEI 96-07 Revision 1 describes 90-day limit for a temporary alteration for maintenance without performing a 10CFR50.59 evaluation.

- **Use risk where application is supported**
- **Regarding CT change in TS;**
 - **RG1.177: Permanent change**
 - **Risk-Informed TS Initiative 4B: Voluntary change with CRMP**

The guidelines* and the amended TS of pilot plants recently approved by the NRC**

* **NEI 06-09 (Revision 0) “Risk-Informed Technical Specifications Initiative 4b Risk- Managed Technical Specifications (RMTS) Guidelines,”** November 2006.

** South Texas Project Unit 1 and 2

➤ **Calculate Risk-informed CT (RICT)**

- **Maintain plant operation within risk thresholds specified in NEI 06-09**
- **Apply formally-approved CRMP and associated living PRA**
- **CT is changed from the front-stop CT* up to RICT**
- **Limited by the 30-day back-stop CT**

* The front-stop CT is the time to complete the required action in the LCO

Risk Thresholds in NEI 06-09



(Quoted from NEI 06-09)

Criterion*		Maintenance Rule Risk Management Guidance	RMTS Risk Management Guidance
CDF	LERF		
$\geq 10^{-3}$ events/year	$\geq 10^{-4}$ events/year	- Careful consideration before entering the configuration (none for LERF)	- Voluntary entrance into configuration prohibited. If in configuration due to emergent event, implement appropriate risk management actions.
ICDP	ILERP		
$\geq 10^{-5}$	$\geq 10^{-6}$	- Configuration should not normally be entered voluntarily	- Follow the Technical Specification requirements for required action not met.
$\geq 10^{-6}$	$\geq 10^{-7}$	- Assess non-quantifiable factors - Establish compensatory risk management actions	- RMAT and RICT requirements apply - Assess non-quantifiable factors - Implement compensatory risk management actions
$< 10^{-6}$	$< 10^{-7}$	- Normal work controls	- Normal work controls

RMAT: Risk Management Action Time

* In application of these RMTS criteria, the criteria for both columns apply simultaneously and actions are taken based on the more restrictive one.

Examples of systems to apply RMTS

➤ Safety Fluid Systems

- Safety Injection Systems with Direct Vessel Injection
- Containment Spray Systems/Residual Heat Removal Systems,

➤ Safety Electrical Systems

- Emergency Power Sources

➤ Others

- Essential Service Water Systems
- Component Cooling Water Systems

Examples of US-APWR RMTS



➤ Limiting Condition for Operation (LCO) of Safety Injection System (SIS)

3.5.2 SIS - Operating

LCO Three of four SIS trains shall be OPERABLE.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Only two trains operable.	A.1 Restore three trains to OPERABLE status.	72 hours
	<u>OR</u> A.2 Apply the requirement of Specification 5.X	72 hours
B. Required Action and associated Completion time not met.	B.1 Be in HOT STANDBY	6 hours
	<u>AND</u> B.2 Be in HOT SHUTDOWN	12 hours



➤ Administrative Controls

5.x Configuration Risk Management Program (CRMP)

5.x.1 Configuration Evaluation

-Determine whether the configuration is acceptable beyond the completion time.

AND

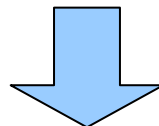
- Restore three trains to operable status within the time **specified in 5.x.2**, or 30 days whichever is less.

5.x.2 Risk-Informed Completion Time (RICT)

Calculate RICT in accordance with **NEI 06-09, "Risk-Managed Technical Specifications (RMTS) Guidelines, Rev. 0."**

- **NEI 06-09 requires PRA which meets Capability Category 2 of ASME PRA standard**
 - **MHI can provide its design-specific PRA in the DCD that essentially* satisfies the Category 2 standard**

* Plant specifics in COLA



**RMTS is framework for
the US-APWR Technical
Specifications**

What MHI plans to submit at each stage in applying RMTS



Stage	Tech. Spec. (Incl. RMTS)	Associated Documents
DC	Design-specific (some CTs may remain TBD)	Design-specific PRA results consistent with DCD Chapter 19 to support RMTS, description of maintenance practices supporting CRMP
COLA	Plant-specific (All CTs established)	Plant-specific PRA results consistent with FSAR Chapter 19 to support RMTS, description of maintenance practices supporting CRMP
Prior to fuel load	Plant-specific (All CTs established)	<ul style="list-style-type: none">● Technical report describing PRA technical adequacy, CRM tools, CRMP, Organization, Training of personnel, etc*● Implementation manual● All required ITAAC

* In accordance with NEI 06-09

- **Application of Surveillance Frequency Control Program (SFCP) in accordance with NEI 04-10, "Risk-Informed Technical Specifications Initiative 5B; Risk-Informed Method for Control of Surveillance Frequencies"**
- **MHI is following the progress of the PWR pilot program**

Summary



- **Establish 3-train LCO to permit on-line maintenance**
- **Apply RMTS to determine completion times when appropriate**
 - **The RMTS framework will be utilized for the US-APWR as part of the Design Certification.**
 - **The necessary information for RMTS implementation will be specified so that it can be provided prior to fuel load. RMTS will follow NEI Guidance for RICT Thresholds, and PRA quality.**
- ***Questions?***

Abbreviations



- CDF: Core Damage Frequency
- CRMP: Configuration Risk Management Program
- ICDP: Incremental Core Damage Probability
- ILERP: Incremental Large Early Release Frequency
- LCO: Limiting Condition for Operation
- LERF: Large Early Release Frequency
- RICT: Risk-Informed Completion Time
- RMTS: Risk-Managed Technical Specifications