



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.
$\geq 10^{-6}$	$\geq 10^{-7}$	<ul style="list-style-type: none"> <li>- Assess non-quantifiable factors</li> <li>- Establish compensatory risk management actions</li> </ul>	<ul style="list-style-type: none"> <li>- RMAT and RICT requirements apply</li> <li>- Assess non-quantifiable factors</li> <li>- Implement compensatory risk management actions</li> </ul>
$< 10^{-6}$	$< 10^{-7}$	- 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**

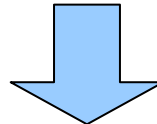
- Restore three trains to operable status within the time **specified in 5.x.2**, or 30 days whichever is less.

#### 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



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

\* 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