US-APWR DCD Chapter 3
Detailed Plan for
Piping Systems and Components

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Background

- MHI original commitment to the NRC was to close the DAC for the selected piping systems and components (PSC) (MHI Letter for the DCD submittal dated Dec. 31, 2007).
- Stress analysis reports and related information for audit, originally planned for June and September 2009 respectively, will now be available consistent with the planned engineering and procurement schedule.

Objectives

- Provide the NRC with adequate Stress Analyses information to have reasonable assurance that safety requirements are met for a design that is essentially complete prior to material procurement/fabrication and stress analysis completed for risk significant items prior to construction.
- Assure an Engineering Completion Schedule to meet the objective above is attainable.
- MHI now plans to provide sufficient information to the NRC to close all PSC DAC in the DCD.

Summary: Primary Milestones for US-APWR Engineering Schedule

- MHI will submit the summary of "Design Specifications and Stress Reports" on ASME Class 1 Piping Systems and Components by 3/09.
- MHI will submit key Class 2 Piping Systems and Components as per prior bullet (Accumulator and Main Steam Line Piping).
- MHI will generate "Design Specification Templates" including Content for All Class 2 and 3 Piping Systems and Components by 12/09 or before. They will be available for NRC audit.
- MHI will provide "Risk Significant" PSC Stress Analyses prior to construction and these analyses will be available for NRC audit.

Contents

- Today, MHI will present additional detailed information on:
  - i) Philosophy of design completion for the PSC (i.e. how the design will be completed)
  - ii) Detailed selection of key PSC based on risk significance
  - iii) Planned engineering

1. Philosophy of Design Completion for the PSC

Design Process for Piping Systems and Components (1/2)
(General Process following ASME Guidance)

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Design Phase

Design Specification

Code & Standard

Requirements
- Materials
- Manufacturing
- Test & Examination
- Quality Assurance

Design Input
- Structure (incl. supports)

Design Transients
- Temperature
- Pressure

Load Conditions
- Seismic Load
- Accident Load
- Thermal Load
- Dead Weight

Other Conditions
- Design Life

Stress Report

Modeling

Methodology

Sizing Calculation

Analysis
- Heat Transfer
- Stress
- Fatigue

Evaluation
- Normal
- Accident
- Seismic
- Thermal
- Fatigue
- Addition for piping
  - LBB
  - Steam hammer
  - Thermal stratification

Available for NRC during DCD review phase

Technical Report
- Summary of Design Specification
- Summary of stress reports (for selected main parts)

Audit
- Design Specification
- Stress reports

DAC Closed

Construction Phase

RPE

RPE

(CDS) Certified Design Specification

Reconciliation / ASME Design Report

RPE: Registered Professional Engineer

Design Process for Piping Systems and Components (2/2)

1. Design process of PSC consists of "Design Specification" and "Stress Report." "Design Specification" includes design input for the "Stress Report" design output.
2. Methodology for "Stress Report," consistent with ASME guidance is described in the DCD.
3. "Technical report" to be submitted, as per schedule commitments to the NRC, will be the summary of "Design Specification" and "Stress Report".
4. At NRC audit, design input and design output will be available.
5. Two of the technical reports related to the design conditions will be submitted in January 2009. These conditions will be used for "Design Specification".
   - ✓ Summary of Design Transients
   - ✓ Summary of Seismic and Accident Load Conditions for Primary System Components and Piping Design

Philosophy of Design Completion

- MHI's general principles for design completion:
  - ✓ All of "Design Specifications" are to be prepared by MHI.
  - ✓ "Stress Reports" are to be prepared by ASME qualified manufacturers (including MHI) who will actually fabricate the related items.
  - ✓ As-build PSC are to be reconciled with ASME "Design Reports" during construction.
- PSC which significantly contribute to risk and/or require unique fabrication techniques will be examined to ensure the performance and reliability.

  => "Design Specification" should be verified by "Stress Report" prior to construction
- More conventional items, such as piping, valves and pumps, will be supplied by numerous vendors.

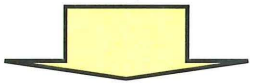
  => "Design Specification" will be met by experienced suppliers. "Stress Report" will be prepared prior to material procurement.

MHI General Plan (1/3)

- **Risk significant and/or unique-fabrication-required PSC:**
  - ✓ "Design Specifications" for ASME Class 1, 2 and 3 PSC will be prepared by MHI during the DCD review phase.
  - ✓ As-designed "Stress Reports" for ASME Class 1 PSC and representative examples for ASME Class 2 PSC (Accumulator and MS piping) will be also prepared by MHI during the DCD review phase.
  - ✓ Technical reports, the summary of "Design Specifications" and "Stress Reports," will be submitted to the NRC for those PSC identified above.
  - ✓ Design methodology for the remaining PSC is practically the same as that for ASME Class 1 and representative examples.
  - ✓ However, "Stress Reports" for the PSC which contribute significantly to risk will be prepared prior to construction.
  - ✓ Design input and design output will be available at NRC audit.

MHI General Plan (2/3)

- Remaining low risk and/or conventional PSC:
  - ✓ "Design Specifications" will be prepared by MHI during the DCD review phase.
  - ✓ Numerous ASME qualified vendors are available to manufacture those PSC.
  - ✓ "Stress Reports" will be prepared by those vendors prior to material procurement. However, because of the importance of the piping design to the plant engineering, "Stress Reports" for piping will be prepared by MHI.
  - ✓ "Design Specification" will be met by experienced suppliers.



- MHI original commitment to the NRC was to close the DAC for the selected piping systems and components.
- However, MHI expects that the above plan will provide sufficient information to the NRC to close all PSC DAC during the DCD review phase.

MHI General Plan (3/3)

Piping Systems and Components				Design Completion	
				Design Specification	Stress Report
ASME Class 1	Components			12/2008	3/2009
	Valves	Risk significant		9/2009	by 6/2012
		Low risk		9/2009	*
	Piping	Risk significant		12/2008	3/2009
		Low risk		12/2008	*
ASME Class 2 & 3	Components	Risk significant		12/2008 or 9/2009	by 6/2012
		Low risk	Representative item (Accumulator)	12/2008	3/2009
			Others	9/2009	*
	Valves	Risk significant		9/2009	by 6/2012
		Low risk		9/2009	*
	Piping	Risk significant	Representative item (MS piping)	12/2008	3/2009
			Others	9/2009	by 6/2012
		Low risk		9/2009	*

*: Prior to material procurement

Details to be provided in a proprietary document

2. Detailed Selection of Key PSC based on Risk Significance

Selection of Piping Systems and Components based on Risk Significance

- Information of Probabilistic Risk Assessment (PRA) and other risk significant evaluation were applied to identify risk significant piping systems and components
- Risk significant evaluation:

✧ Basic events
- Fussell-Vesely importance (FV)

OR
- Risk Achievement Worth (RAW)

✧ Initiating event groups
- Contribution to the Core Damage Frequency (CDF)

OR
- Conditional Core Damage Probability (CCDP)

Application of Risk Significant Information to Piping Systems and Components

- Risk significant piping systems and components identified by FV/RAW or CDF/CCDP
- Apply the above to the DCD Chapter3 Table 3.2-2 (see the separate proprietary document)

Summary of the identified items

ASME Class	Components	Valves	Piping	Total
Class 1	6	7	14	27
Class 2	3	1	9	13
Class 3	12	0	16	28

3. Planned Engineering for Piping Systems and Components Design

Planned Engineering for ASME Class 1 Components

- ASME Class 1 Components are designed at the early phase of engineering activities.
- ASME Class 1 Components, which require high manufacturing accuracy and reliability, are built by MHI.
- Stress Analyses are performed by MHI in accordance with "Design Specifications."
- "Design Specifications" will be available in 12/2008, and "Stress Reports" will be available in 3/2009.

Planned Engineering for ASME Class 2 & 3 Components

- ASME Class 2 & 3 Components are manufactured by vendors who have experience supplying the conventional components. It is noted that Accumulator will be built by MHI.
- Stress Analyses will be performed by vendors in accordance with "Design Specifications" at the procurement phase.
- Engineering/Manufacturing are performed consistent with installation at the plant.
- "Design Specifications" for Risk Significant components will be available in 12/2008 or 9/2009.
- "Stress Report" for Accumulator as a representative example will be available in 3/2009
- "Stress Reports" for Risk Significant components will be available before construction start.

Planned Engineering for ASME Class 1 – 3 Valves

- ASME Class 1 - 3 Valves are manufactured by vendors who have experience supplying the conventional valves.
- Stress Analyses are performed by vendors in accordance with "Design Specifications" at the procurement phase.
- ASME Class 1 - 3 Valves are designed at the later phases of engineering activities.
- "Design Specifications" for Risk Significant valves will be available in 9/2009.
- "Stress Reports" for Risk Significant valves will be available before construction start.

Planned Engineering for ASME Class 1 – 3 Piping

- ASME Class 1 - 3 Piping are provided by vendors with experience supplying the conventional piping.
- Because of the importance of the piping design to the plant engineering, Stress Analyses are performed by MHI with detailed engineering of Piping/Supports.
- Engineering/Manufacturing are performed consistent with installation at the plant.
- "Design Specifications" for Risk Significant piping will be available in 12/2008 or 9/2009.
- "Stress Reports" for Risk Significant Class 1 and MS Piping will be available in 3/2009.
- "Stress Reports" for Risk Significant piping will be available before construction start.

Submittal Plan for Technical Reports for the Selected Components and Piping

Areas	Contents		Technical Report
Components and pipng	ASME Class CS	Reactor Internals	3/2009
	ASME Class 1	Reactor Vessel	3/2009
		Steam Generator	3/2009
		Pressurizer	3/2009
		Reactor Coolant Pump	3/2009
		CRDM	3/2009
		Reactor Coolant Loop Piping	3/2009
		RCL Branch Piping	3/2009*
		Pressurizer Surge Line Piping	3/2009
	ASME Class 2	Accumulator	3/2009
		MS Piping	3/2009

* Risk significant Piping only

Summary

- MHI now plans to provide sufficient information to the NRC to close all DAC for the piping systems and components in the DCD.
- Stress analysis reports and related information for audit , originally planned for June and September 2009 respectively, will now be available consistent with the planned engineering or procurement schedule.
- Today, MHI is anticipating feedback from the NRC.