US-APWR

7th Pre-Application Review Meeting
Technical Specifications
for Unique Design Features

June 13, 2007

Mitsubishi Heavy Industries, Ltd.

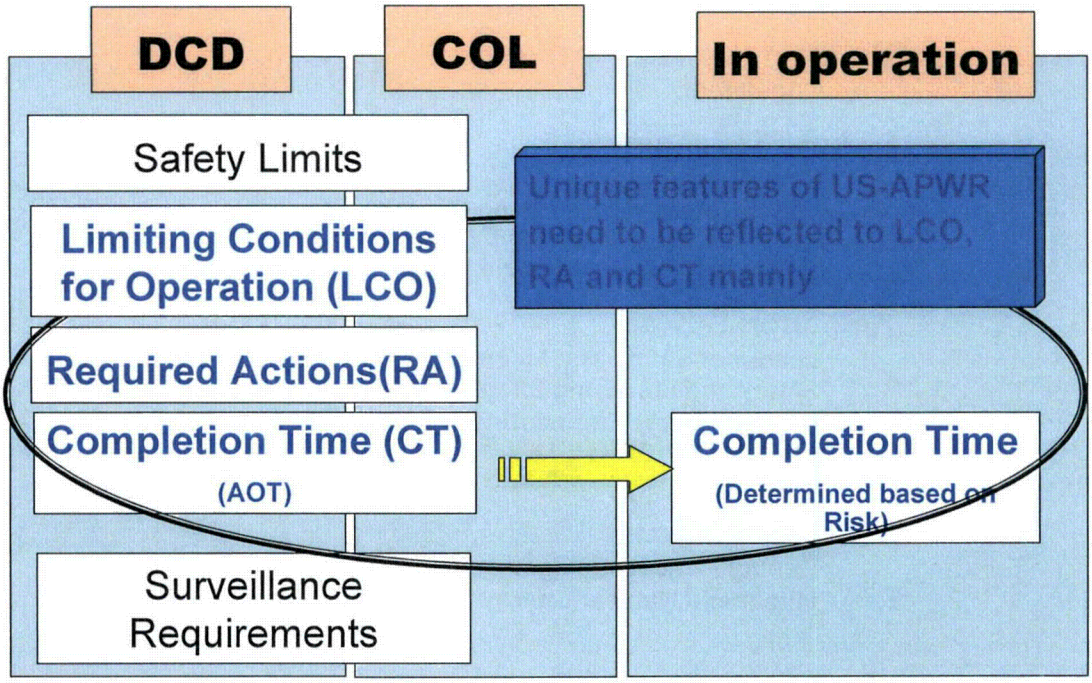
Meeting Attendees

- ✓ **Mr. George Vaux** - Presenter –
  - Consultant
- ✓ **Makoto Takashima**
  - Deputy chief Engineer
  - Water Reactor Engineering Department
    Nuclear Energy Systems Engineering Center
  - Mitsubishi Heavy Industries, LTD.
- ✓ **Katsunori Kawai**
  - Leader of Safety and Licensing Group
  - Safety and Licensing Integration Group
  - Reactor Safety Engineering Department
    Nuclear Energy Systems Engineering Center
  - Mitsubishi Heavy Industries, LTD.
- ✓ **Takahiro Imamura**
  - Deputy Project Manager
  - Mitsubishi Nuclear Energy Systems, Inc

Objectives of Meeting

- Provide the general design approach and specific design features of the US-APWR relevant to the Technical Specifications
- Describe Limiting Conditions for Operation (LCO) and Actions for main features of US-APWR
- Present the basic approach for developing the Technical Specifications
- Obtain feedback from the NRC concerning the Technical Specifications for the US-APWR

Overview of US-APWR Technical Specifications



Outline

1. Basic design concept of US-APWR
2. Design features of US-APWR
3. Basic approach for developing Technical Specifications
4. Plan of Technical Specifications for unique features of US-APWR
5. Summary

1. Basic Design Concept of the US-APWR

Basic Design Concept of the US-APWR

- US-APWR design concept is based on conventional U.S. PWR
  - Primary and secondary system configuration, reactor control and protection system functional design, etc.
- Use of proven, accepted technologies with improvements to enhance safety
  - Highly reliable prevention functions
  - Well-established mitigation systems with active safety functions and passive safety functions
  - Functions to protect against beyond design basis accidents

2. Design Features of US-APWR

Comparison of Plant Configuration

			Current 4 Loop Plant*	US-APWR
Safety Systems	Trains	Electrical	2 trains	4 trains
		Mechanical	2 trains	4 trains
	Systems	SIS	100% x 2	50% x 4 (Direct Vessel Injection)
		ACC	4	4 (Advanced ACC)
		HVAC	2	2 and 4
I & C	Safety I&C		Conventional	Full Digital
Severe Accident Mitigation Features			-	Planned as part of design activities

*Callaway NPP

- Almost all other systems are similar to conventional 4 loop plant from the point of view of Technical Specifications.

Breakdown of Safety Fluid Systems

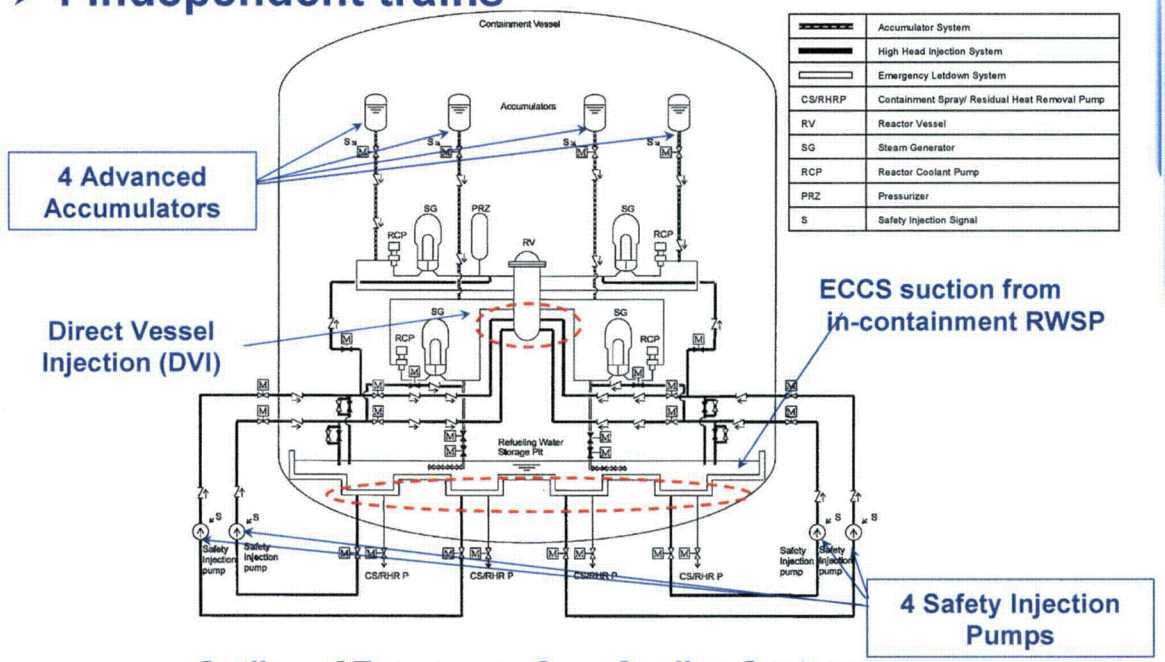
- Breakdown of Safety fluid systems by number of trains required for operations, available to meet single failure criterion, and available for On-Line Maintenance (OLM)

	Number of total trains	Minimum number of trains required for operation (N)	Train available to meet single failure criterion	Train lost due to Large Break LOCA	Train available for OLM
SIS (DVI), CSS/RHR, EFWS,ESWS	4	2	1	N/A	1
Advanced Accumulator	4	3	N/A (Passive Component)	1	N/A

SIS: Safety Injection System, CSS: Containment Spray System, RHR: Residual Heat Removal System, EFWS: Emergency Feed Water System, ESWS: Essential Service Water System

Breakdown of Safety Fluid Systems (cont.)

➢4 Independent trains



Outline of Emergency Core Cooling System

Breakdown of Digital I & C Systems

➢ Breakdown of Digital I & C systems by number of trains required for operations, available to meet single failure criterion, and available for OLM

	Number of total trains	Minimum number of trains required for operation (N)	Train available to meet single failure criterion	Train available for OLM
Reactor Protection Systems	4	2	1	1

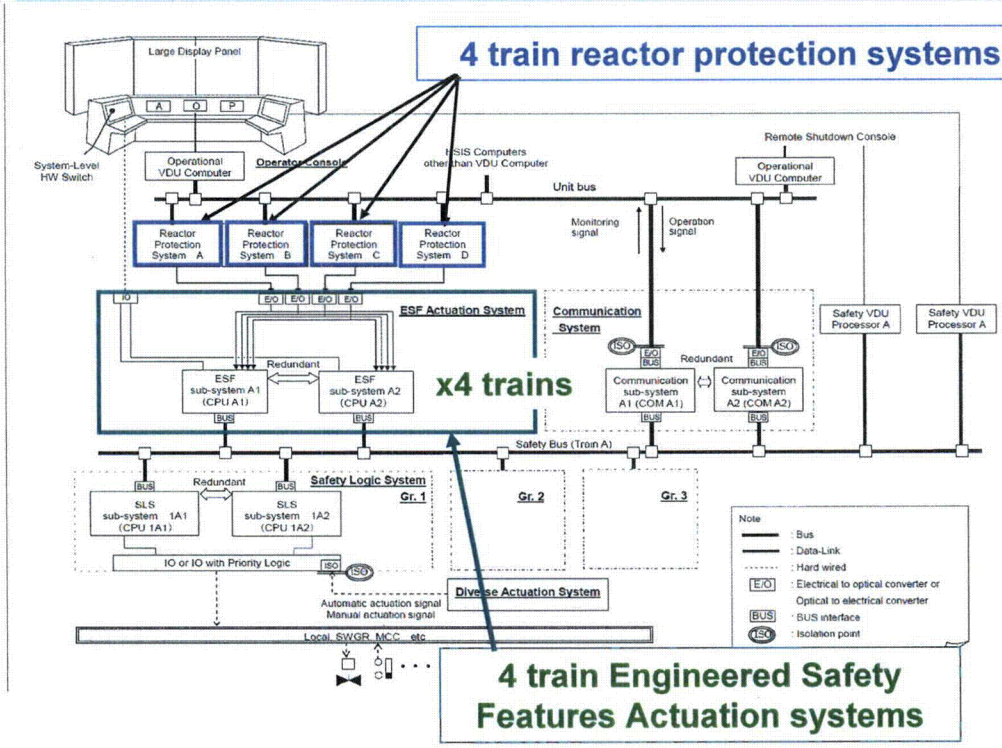
Breakdown of Digital I & C Systems (cont.)

- Breakdown of Digital I &C systems by number of trains required for operations, available to meet single failure criterion, and available for OLM

[Engineered Safety Features Actuation Systems (ESFAS)]

Number of total actuated trains	Minimum number of trains required for operation (N)	Train available to meet single failure criterion	Notes
4 (Ex. SIS)	2	1	No maintenance causes loss of function
2 (Ex. Isolation Valve)	1	1	

Breakdown of Digital I & C Systems (cont.)

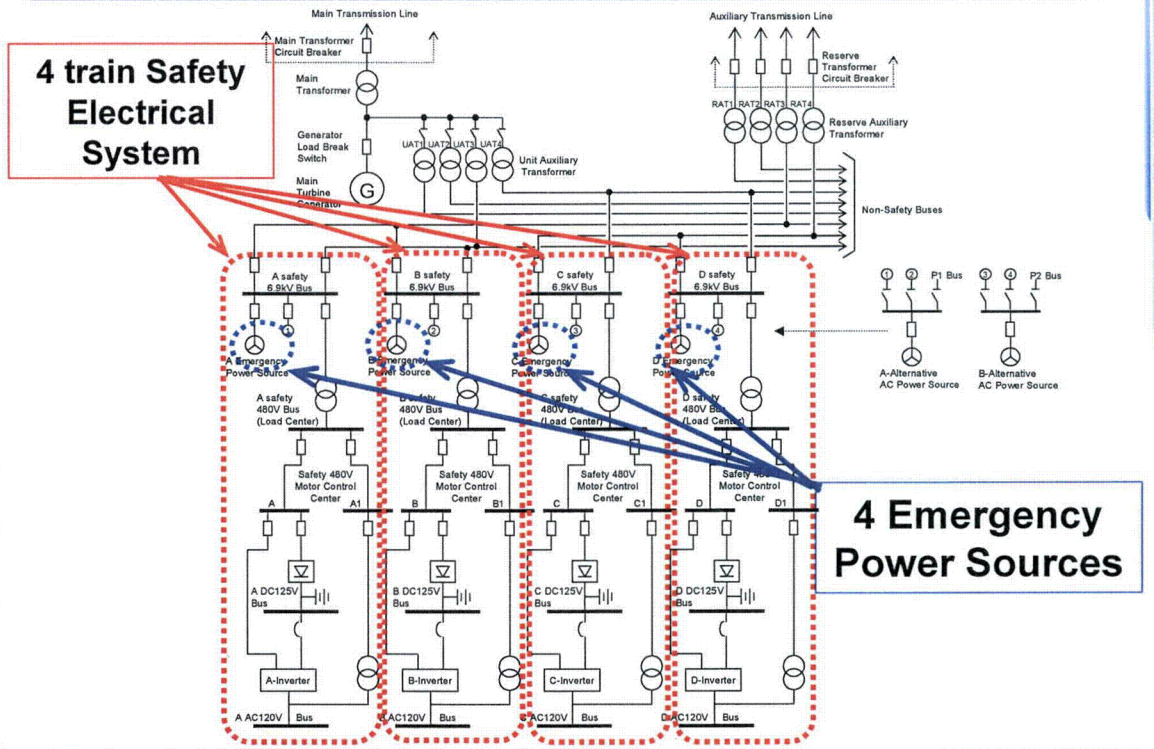


Breakdown of Safety Electrical Systems

- Breakdown of safety electrical systems by number of trains required for operations, available to meet single failure criterion, and available for OLM

	Number of total trains	Minimum number of trains required for operation (N)	Train available to meet single failure criterion	Train available for OLM
Emergency Power Source	4	2	1	1
Safety Bus	4	2	1	1

Breakdown of Safety Electrical Systems (cont.)

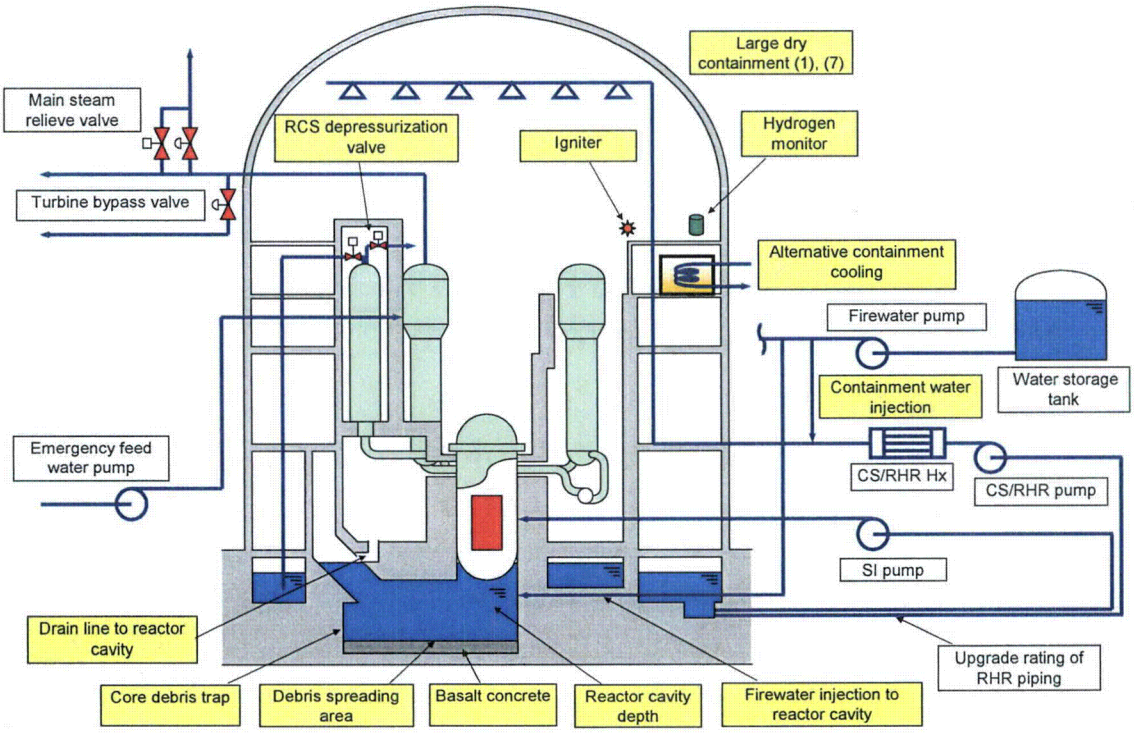


Breakdown of Severe Accident Mitigation Systems

- Breakdown of Severe Accident Mitigation trains by number of trains required for operations, available to meet single failure criterion, and available for OLM

	Number of total trains	Minimum number of trains required for operation (N)	Train available to meet single failure criterion	Train available for OLM
Igniters	To be determined	To be determined	N/A	N/A
RCS depressurization valves	1 (2 valves)	1 (2 valves)	N/A	N/A
Fire Water Pumps	To be determined	To be determined	N/A	N/A

Breakdown of Severe Accident Mitigation Systems (cont.)



3. Basic Approach for Developing Technical Specifications

Basic Approach for Developing Technical Specifications

- Intended compliance with U.S. regulatory requirements and standards
  - 10CFR50.36
  - 10CFR50.65
  - NUREG-0800 Chapter 16 Rev.2, 16.1 Rev.1
  - Regulatory Guide 1.206 (DG-1145)
  - Industry Standard Writer's Guide
    - TSTF-GG-05-01 Writer's Guide for Plant-Specific Improved Technical Specifications
- Modeled after NUREG-1431 Rev. 3.1, "Standard Technical Specifications for Westinghouse Plants"

4. Plan of Technical Specifications for Unique Features of US-APWR

(1) Technical Specifications for N+2 Train Safety Systems

- Examples
  - Safety Injection System, Containment Spray System, etc.
- Detail of numbers of trains
  - N is number of trains required for operation
  - 1 train available to meet single failure criterion
  - 1 train available for OLM
- LCO
  - N+1 independent trains shall be operable in order to meet single failure criterion
- Allowed duration for out-of-service trains
  - AOT (Risk evaluated under CRMP)

CRMP: Configuration Risk Management Program, which manages the increase in risk that may result from maintenance work.

AOT : Allowed Outage Time

(1) Technical Specifications for N+2 Train Safety Systems (cont.)

- Limitation on out-of-service for safety 4 train systems

Operable train	Reason for out-of-service	Action or Limitation for outage time
4	-	-
3	1 OLM or 1 Failure	No limitation (Note)
2	[1 OLM and 1 Failure] or [2 Failures]	AOT (Note)
1	[1 OLM and 2 Failure] or [3 Failures]	Immediately initiate mode reduction

Note: Risk evaluated under CRMP

(2) Technical Specifications for N Train Safety Passive System

- Example
  - Advanced Accumulator
- Detail of numbers of trains
  - N is number of trains required operation
- LCO
  - N trains are operable
- Allowed duration of out-of-service train
  - AOT

(2) Technical Specifications for N Train Safety Passive System (cont.)

- Limitations on out-of-service for Advanced Accumulator

Operable train	Reason for out-of-service	Action or Limitation for outage time
4	-	-
3	1 Out for Maintenance	AOT
2	2 Out for Maintenance	Immediately initiate mode reduction

(3) Potential Technical Specifications for Severe Accident Mitigation Features

- Example
  - Igniters, RCS depressurization valves
- Detail of numbers of trains
  - N is number of trains required
- LCO
  - N/A: Severe accident mitigation features are "Beyond the design basis". These are non-safety in the same way as for existing plants. If LCOs are required by criterion 4 of 10 CFR 50.36, Technical Specifications will include LCOs.
- Duration of out-of-service
  - To be determined by the CRMP

(3) Potential Technical Specifications for Severe Accident Mitigation Features (cont.)

- Limitation on out-of-service for severe accident mitigation features

Operable train	Reason for out-of-service	Action or Limitation for outage time
N	-	-
N-1	1 OLM or 1 Failure	To be determined by the CRMP if LCO required by criterion 4 of 10 CFR 50.36

5. Summary

Summary

- US-APWR design concept is based on conventional U.S. PWR and includes enhanced safety features using proven, accepted technologies.
- N+2 design facilitates On-Line Maintenance without entering LCO
- Intended compliance with U.S. regulatory requirements and standards
- Technical Specification based on Standard Technical Specifications of NUREG-1431 Rev.3.1
- LCO outage time based on AOT or time determined by the CRMP