US-APWR

7th Pre-Application Review Meeting

Contents of Design Control Document

June 13, 2007

Mitsubishi Heavy Industries, LTD.

Meeting Attendees

✓**Masayuki Kambara**
(Representative for US-APWR Licensing)
- Project Manager
- Mitsubishi Nuclear Energy Systems, INC.

✓**Masahiko Kaneda**
(Responsible for US-APWR Licensing)
- General Manager
- APWR Promoting Department
- Mitsubishi Heavy Industries, LTD.

✓**Makoto Takashima**
(Responsible for I&C and Electrical Design)
- Deputy Chief Engineer
- Water Reactor Engineering Department
  Nuclear Energy Systems Engineering Center
- Mitsubishi Heavy Industries, LTD.

✓**Tomoyuki Kitani**
(Responsible for Structural Design)
- Acting Manager
- Structural & Seismic Engineering Section
  Nuclear Energy Systems Engineering Center
- Mitsubishi Heavy Industries, LTD.

Meeting Objectives

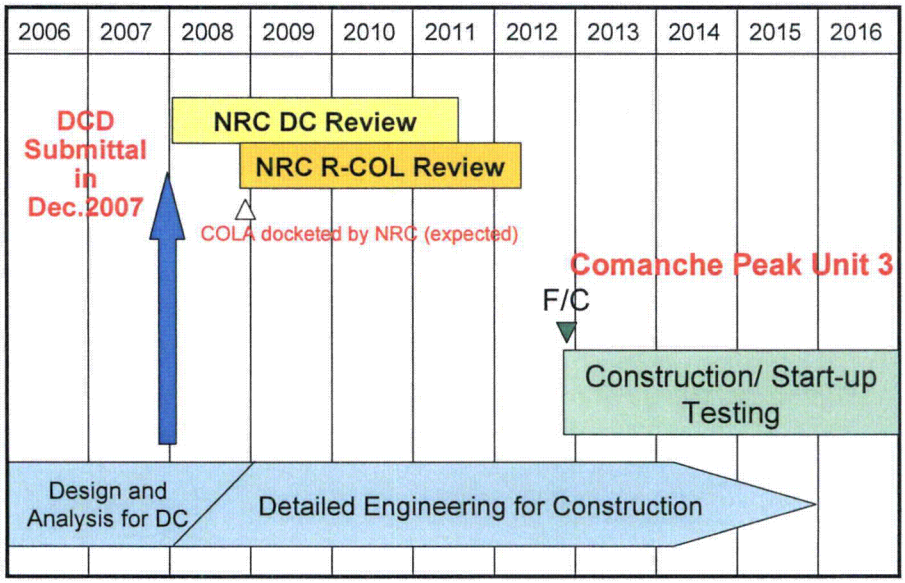
- To outline the design process and time-line for US-APWR
- To explain the level of standard design completion during the DC review
- To explain MHI's plan to Physical Security in DCD
- To discuss with NRC to define the requirements for DCD

Meeting Outline

1. US-APWR Design Process and Time-line
2. Overview of DCD Structure
3. Key Areas of DCD to be Discussed
   - 3.1 Level of Standard Design Completion
     Systems, Structures, Components, Piping, Fuel Assemblies, I&C, HFE, Electrical Power
   - 3.2 Contents of Physical Security for DCD
4. Overall Plan of DCD/COLA and Report Submittal
5. Others
   - 6.1 Units used in DCD and Relevant Reports
   - 6.2 ASME editions used in DCD and Relevant Reports

1. US-APWR Design Process and Time-line

US-APWR Present Design Process and Time-line



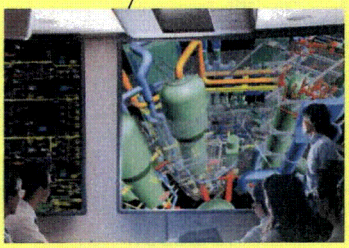
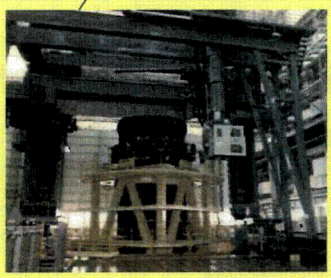
Notes:
F/C: First Concrete
C/O: Commercial Operation

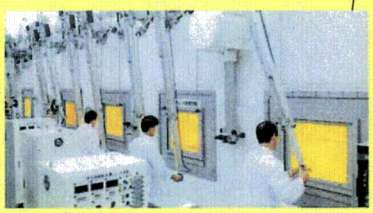
Mitsubishi's Consistent Design throughout Design/Construction Process

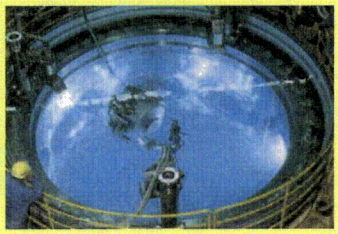
Note: Not in scale

Nuclear Power Plant Design and Construction Process

Planning	Design	Manufacturing	Construction	Start-up Test
	R & D	Procurement		





2. Overview of DCD Structure

DCD Structure

- **A two-tiered structure**

  Based on the staff requirements memorandum (SRM), dated February 14, 1991, "Requirements for Design Certification Under 10 CFR Part 52," dated November 8, 1990

- **Tier 1**

  Tier 1 information is the portion of the design-related information contained in the generic Design Control Document (DCD) that is certified by NRC through rulemaking

- **Tier 2**

  Tier 2 is that portion of the design-related information in the generic DCD that is approved, but not certified by the design certification rule

Contents of Tier 1

- **Definitions and general provisions**
- **Design descriptions**

  Top-level design features and performance standards for the structures, systems, and components (SSCs)

- **Inspections, tests, analyses, and acceptance criteria (ITAAC)**

  To ensure that a plant licensed in accordance with 10 CFR Part 52, has been properly constructed and will operate safely

- **Significant site parameters**

  The top-level site parameters

- **Significant interface requirements**

  Interface requirements that must be met by the site-specific portions of a facility that are not within the scope of the certified design

Contents of Tier 2

Ch. 1 Introduction and General Description of the Plant
Ch. 2 Site Characteristics
Ch. 3 Design of Structures, Systems, Components, and Equipment
Ch. 4 Reactor
Ch. 5 Reactor Coolant and Connecting systems
Ch. 6 Engineered Safety Features
Ch. 7 Instrumentation and Controls
Ch. 8 Electric Power
Ch. 9 Auxiliary Systems
Ch.10 Steam and Power Conversion System
Ch.11 Radioactive Waste Management
Ch.12 Radiation Protection
Ch.13 Conduct of Operations
Ch.14 Initial Test Program
Ch.15 Transient and Accident Analyses
Ch.16 Technical Specifications
Ch.17 Quality Assurance & Reliability Assurance
Ch.18 Human Factors Engineering
Ch.19 Probabilistic Risk Assessment and Severe Accident Evaluation

Design completion level to be discussed

Contents of Physical Security for DCD to be discussed

3. Key Areas of DCD to be Discussed

3.1 Level of Standard Design Completion

Previous Applicability of DAC

- **Regulatory Position** (SECY-92-053)

  > The primary reasons for the vendors not providing this detailed design information include a consideration of: (1) technologies that are changing so rapidly that it would be unwise for the NRC to freeze the details of the design many years before an actual plant is ready to be constructed, and (2) design areas such as pipe stress and support analyses, where vendors do not have sufficient as-built, or as-procured information to complete the final design.

  - ✓ **Guideline 1: Technologies changing rapidly**
  - ✓ **Guideline 2: Vendors do not have sufficient as-built or as-procured information to complete design**

- **The Four Already Certified Designs used the DAC**
  - ✓ Radiation Protection DAC: Related to DCD Chapter12
  - ✓ Piping DAC: Related to DCD Chapter 3
  - ✓ I&C DAC : Related to DCD Chapter 7
  - ✓ HFE DAC : Related to DCD Chapter 18

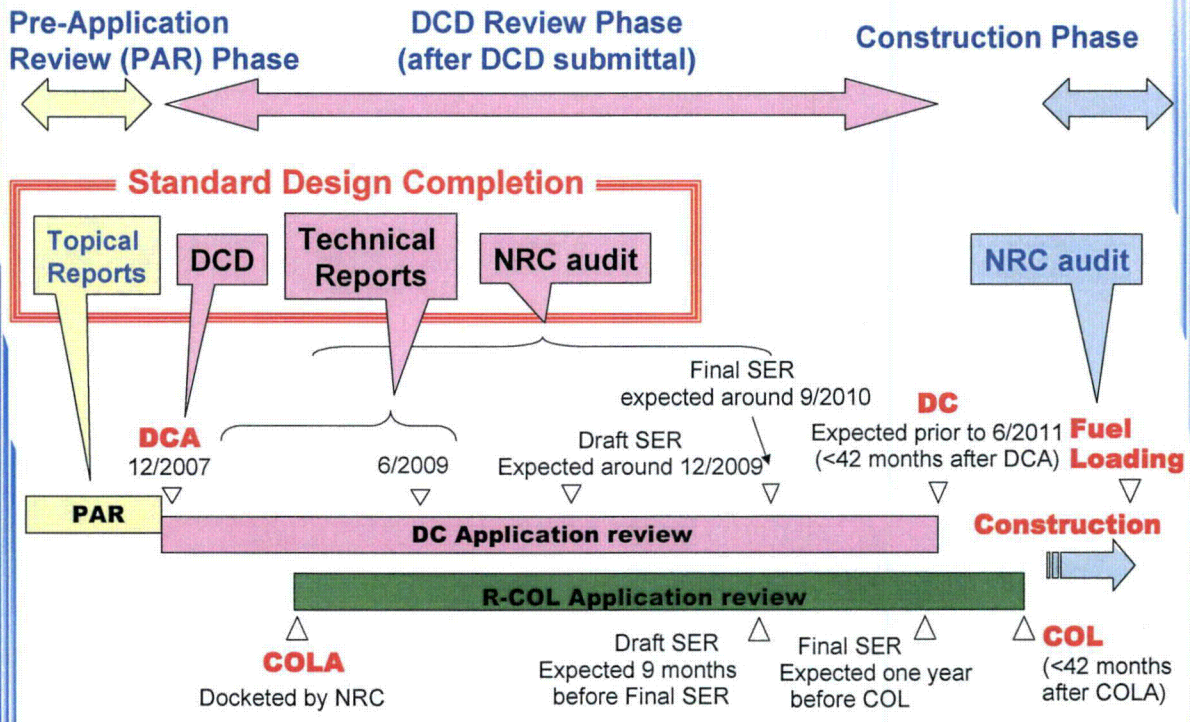
Proposed Plan

- Early submittal of topical reports for the NRC's pre-application review
  - ✓ QA, Advanced accumulator, I&C, HFE, Fuel, Thermal hydraulic design, Safety analysis
- Define level of standard design completion during the DC review
- Standard design completion will be verified in:
  - ✓ DCD (Dec. 2007)
  - ✓ Technical reports (after the DCD submittal)
    - For MHI's commitment to the NRC for the DCD information
  - ✓ NRC review of activities and documents related to detailed design (including NRC audit)
- Remaining design will be verified and/or reconciliated during plant construction phase

⇩

- Discussion with NRC to further define the requirements for DCD

Proposed Plan (cont)



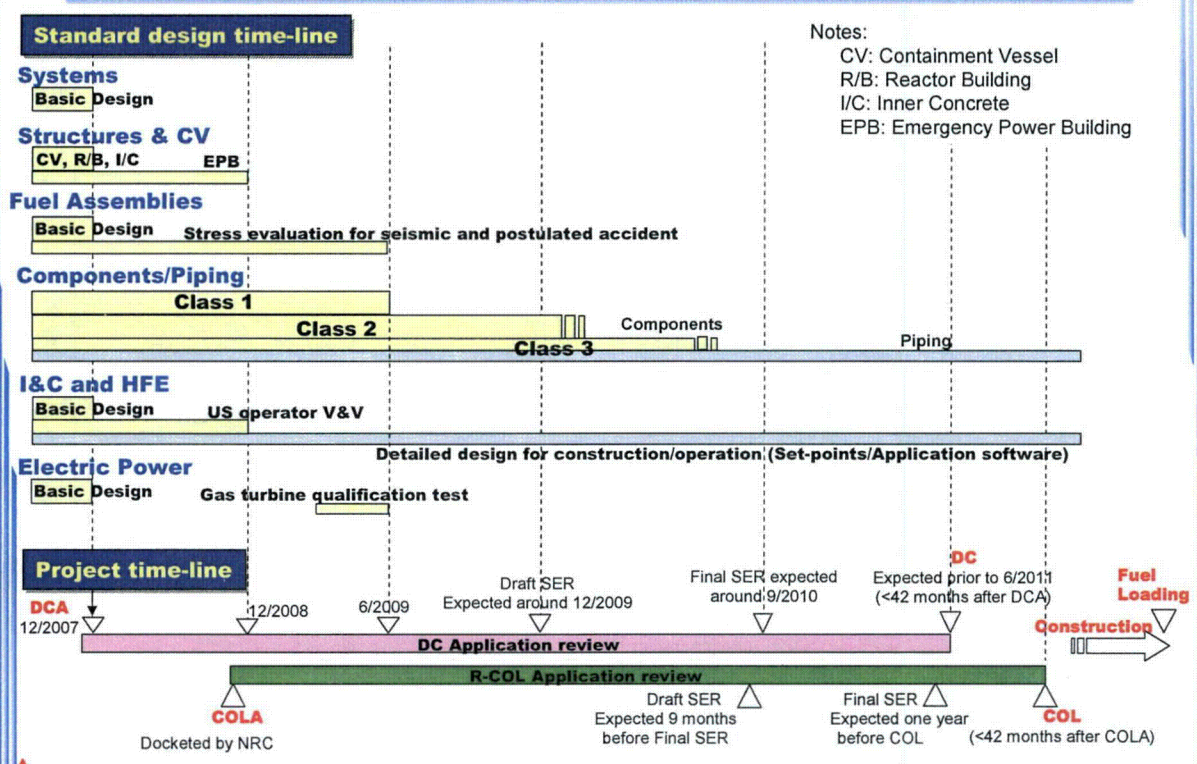
Submittal Plan of Topical Reports during Pre-application Review

Category	Topical Report to be referred in DCD	Submittal Date
Quality Assurance (Ch. 17)	Quality Assurance Program Description for Design Certification of the US-APWR	January 2007 (Submitted)
ESF (Ch.6)	Advanced Accumulator	January 2007 (Rev.0) March 2007 (Rev.1) (Submitted)
I & C (Ch. 7)	Safety System Digital Platform –MELTAC-	March 2007 (Submitted)
I & C (Ch. 7)	Safety I&C System Design Process and Description	March 2007 (Submitted)
I & C (Ch. 7)	Defense-in-Depth and Diversity	April 2007 (Submitted)
HFE (Ch. 18)	HSI System Description and HFE Process	April 2007 (Submitted)
Reactor (Ch. 4)	Fuel System Design Criteria and Methodology	May 2007 (Submitted)
Reactor (Ch. 4)	Thermal Design Methodology	May 2007 (Submitted)
Accident Analyses (Ch. 15)	Safety Analysis Methodology (LBLOCA, SBLOCA)	July 2007
Accident Analyses (Ch. 15)	Safety Analysis Methodology (Non-LOCA)	July 2007

Level of Standard Design Completion for DCD

- DCD: Most of the standard design
- Standard design completion after the DCD submittal:
  - ✓ Stress evaluation:
    - Fuel Assemblies
    - Components: ASME Class CS, 1, 2, and 3
    - Piping: ASME Class 1, 2, 3
    - Emergency Power Building
  - ✓ I & C Design and Human Factor Engineering (HFE) design
  - ✓ Electrical Power design (Gas turbine generator)
  - ✓ PRA Level 3
    (as discussed in PRA Pre-Application Review meeting in Mar. 2007)

Time-line of Standard Design and US-APWR Project



Design Completion: Stress Evaluation

		DCD Application Review Phase		Construction Phase
		DCD (Submittal in Dec. 2007)	After DCD Submittal	
Structures & CV (Chapter 3)	Seismic Category 1 [Note 1]	✓ General • Codes and standards • Analysis methods • Modeling techniques • Stress analysis criteria ✓ Stress summary: PCCV, R/B, I/C	✓ Stress summary (Technical Report): EPB in Dec. 2008 (Submittal approx. one year after the technical report on Gas Turbine Generator for Emergency Power Source (To be discussed in Electric Power Design)	-
Fuel Assemblies (Chapter 4)		✓ General • Codes and standards • Analysis methods • Modeling techniques • Stress analysis criteria ✓ Design evaluation summary Most of the evaluation	✓ Design evaluation summary (Technical Report) Stress evaluation only for seismic and postulated accidents in June 2009	-

Note 1: Stress summary for the structure of Essential Service Water System (site specific) will be submitted in COLA
Note 2: PCCV: Pre-stressed Concrete Containment Vessel
R/B: Reactor Building
I/C: Inner Concrete
EPB: Emergency Power Building

Design Completion: Stress Evaluation (cont)

		DCD Application Review Phase		Construction Phase
		DCD (Submittal in Dec. 2007)	After DCD Submittal	
Components (Chapter 3 & 5)	ASME Class CS Class 1 Class 2 Class 3	✓General • Codes and standards • Analysis methods • Modeling techniques • Stress analysis criteria	✓ Stress summary (Technical Report): Typical Components (Reactor Vessel, Reactor Internal) in June 2009 ✓ Available for NRC's Audit: Remaining Components	ASME Design Reports available prior to fuel loading
Piping (Chapter 3)	ASME Class 1 Class 2	✓General • Codes and standards • Analysis methods • Modeling techniques • Stress analysis criteria • Support design criteria	✓ Stress summary (Technical Report): Typical Piping (Surge Line, Main Steam Line) in June 2009 ✓ Available for NRC's Audit: Remaining Piping	ASME Design Reports available prior to fuel loading
		• LBB evaluation methods	✓ LBB evaluation results (Technical Report): Typical Piping (Surge Line, Main Steam Line) in June 2009 ✓ Available for NRC's Audit: Remaining Piping	-
	ASME Class 3	✓General • Codes and standards • Analysis methods • Modeling techniques • Stress analysis criteria	-	DAC Closure: ASME Design Reports available prior to fuel loading

Selection of the Examples for Components and Piping

- Design of the components/piping will be verified by the selected examples
- Selection of the examples is based on the highlighted technical aspects

ASME Classification of Typical Components and Piping

	Components (Typical items)	Piping (Typical items)
ASME Class CS	RI	N/A
ASME Class 1	RV, Pressurizer (Pzr), SG, RCP, CRDM, Pzr Relief/Safety Valve	MCP, DVI line, Pzr Surge/Spray/Relief line
ASME Class 2	CS/RHR pump, Acc, SI pump	MS line, FW line, SI line, RHR/ECCS line
ASME Class 3	CCW surge tank, CCW pump Emergency feed water pump	Component cooling water line Emergency feed water line

Notes:
SG: Steam Generator
RCP: Reactor Coolant Pump
CRDM: Control Rod Drive Mechanism
CS/RHR: Containment Spray/Residual Heat Removal
Acc: Accumulator
SI: Safety Injection
MCP: Main Coolant Pipe
DVI: Direct Vessel Injection
MS: Main Steam
FW: Feed water

Selection of the Examples for Components and Piping (con't)

- Components and piping have been selected for DCD assessment taking account of the technical aspects

Categories	Component/Piping	Components		Piping	
		Reactor Internal	Reactor Vessel	Surge Line	Main Steam Line
ASME	Class CS	X			
	Class 1		X	X	
	Class 2				X
Technical Aspects	Irradiation effect	X	X		
	Pressure retaining		X	X	X
	Environmental fatigue effect	X	X	X	
	Internal structure	X			
	Leak Before Break (LBB) evaluation			X	X
	Water hummer effect				X
	Thermal stratification effect			X	

Design Completion: I&C, HFE, and Electric Power Design

	DCD Application Review Phase		Construction Phase
	DCD (Submittal in Dec. 2007)	After DCD Submittal	
I & C design (Chapter 7)	✓ FSAR Level Design Package ✓ Detail Design Process for Set-point, Software and Qualification	-	DAC Closure: The following detailed design documents available prior to fuel loading ✓ Set-points calculations ✓ Application software documents ✓ Equipment qualification reports
HFE design (Chapter 18)	✓ FSAR Level Design Package ✓ Detail Design Process for Plant Specific HIS Detail Design, Final V&V and Training Performance Monitoring	✓ US Operator V & V summary report (Technical Report) in Dec. 2008	DAC Closure: The following detailed design documents available prior to fuel loading ✓ Display design ✓ Design of computer based procedures ✓ Training and Human Performance Monitoring
Electric Power design (Chapter 8)	✓ FSAR Level Design Package ✓ Calculation method for Electrical Power System Design ✓ Gas Turbine Generator Design, Qualification and Test Plan (Technical Report) in Nov. 2007	✓ Available for NRC's Audit: Gas Turbine Generator Test results	-

Summary of Standard Design Completion

- DCD: Most of the standard design
- Technical reports (after the DCD submittal):
  - ✓ Structures (Emergency Power Building)
  - ✓ Fuel Assemblies
  - ✓ Class 1, 2 Components/Piping (Typical Components)
  - ✓ Gas turbine generator
  - ✓ US operator V&V
  - ✓ PRA Level 3 (as discussed in PRA Pre-Application Review meeting in Mar. 2007)
- NRC review of activities and documents related to detailed design (including NRC audit):
  - ✓ Remaining Class 1 and 2 components/piping, Class 3 components
- The followings will be verified and/or reconciliated during plant construction phase to close DAC
  - ✓ Class 3 piping
  - ✓ Plant specific areas of I & C and HFE

3.2 Contents of Physical Security for DCD

Chapter 13 (Physical Security)

Chapter 13 Conduct of Operations

13.6 Physical Security

(1) MHI is proposing to follow the scope of the previously approved DCD for the initial DCD submittal in Dec. 2007

- ✓ It is noted that the exact division between the DCD and the COLAs will be a topic discussed in the US-APWR DCWG
- ✓ The DCD may be amended to include additional information based on the results of the above discussions

(2) MHI plans to separately submit "Security Assessment" for the DCD prior to COLA submittal

(3) With respect to the Beyond Design Basis Threat, MHI plans to do the evaluation upon finding out the NRC's criteria for the evaluation

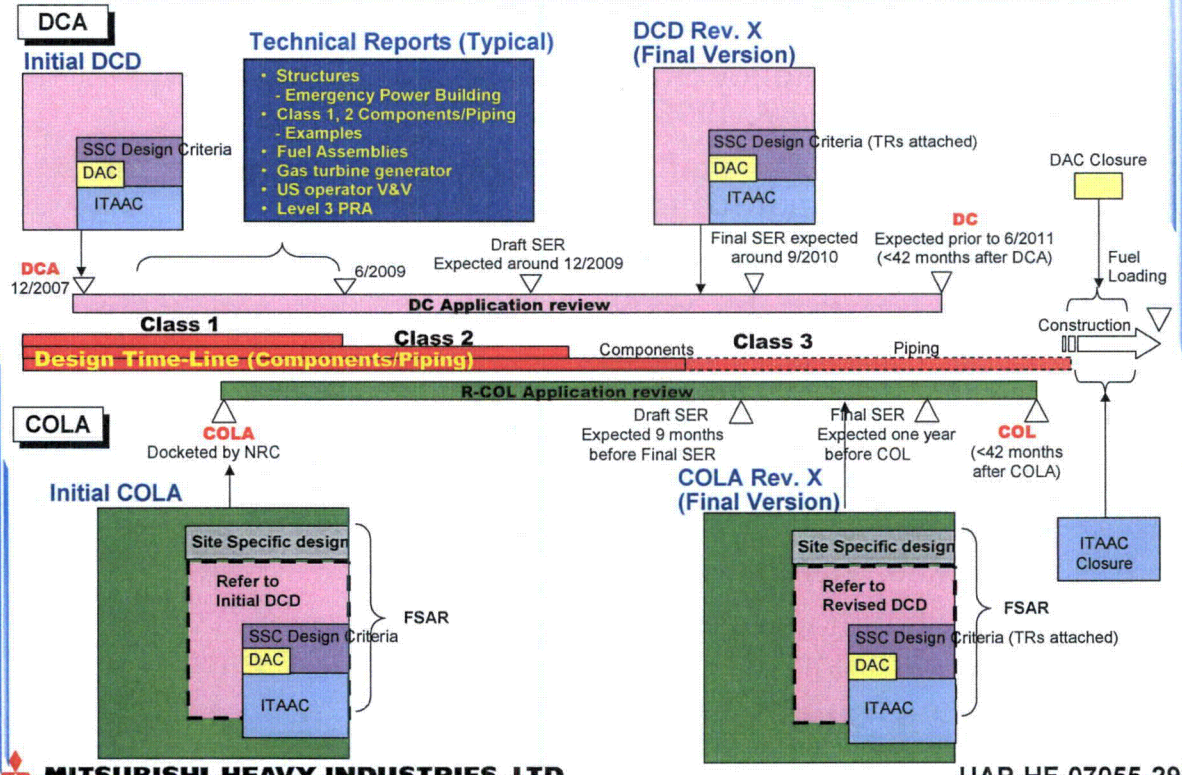
(MHI does not currently expect to file such a report at the time of the initial DCD application in December 2007)

4. Overall Plan of DCD/COLA and Report Submittal

Submittal Plan of Technical Reports during DCD Application Review

Category	Technical Reports to be referred in DCD	Submittal Date
SSCs (Chapter3)	Emergency Power Building design result	Dec. 2008
	Reactor Internal stress summary report	June 2009
	Pressurizer surge line stress summary report	
	MS line stress summary report	
Fuel Assemblies (Chapter 4)	Fuel Assemblies design evaluation summary report for seismic and postulated accidents	
RV (Chapter 3&5)	Reactor Vessel stress summary report	
Electric Power (Chapter 8)	Gas turbine generator design, qualification and test plan report	Nov. 2007
HFE (Chapter18)	US operator V&V summary report	Dec. 2008
PRA (Chapter19)	PRA Level 3 result (already discussed in 5th PAR in Mar. 2007)	Mar. 2008

Overall Plan of DCD/COLA and Technical Report Submittal



5. Others

5.1 Units

5.2 ASME editions

5.1 Units used in DCD and Reports

- SECY-96-098 Final Policy Statement – Conversion to The Metric System (May 7, 1996)
  - ✓ In discussion, "The staff believes that no changes to the Commission's metrication policy are needed."
- 61 FR 31169 "NRC Statement of Policy on Conversion to the Metric System" (June 19, 1996)
  - ✓ English or metric units alone are permissible.
- Unit used in the DCD and related reports for US-APWR is:
  - ✓ English unit
    - Example: 12 ft
    - English unit mainly used for the design, except where it is customary to express a value in metric units.

      e.g. Burn-up = MWd/t

5.2 ASME editions used in DCD and Reports

- The edition of ASME Boiler and Pressure Vessel Code that will be used in the DCD and related reports is:
  - ✓ 2001 edition including 2003 addenda
    - Mainly used for the design of components and piping taking account of the requirements stipulated in 10 CFR 50.55a

Summary

- The current design process and time-line was presented.
- The level of the standard design completion was outlined.
  - ✓ Most of the standard design will be presented in the DCD.
  - ✓ Technical reports will be submitted after the DCD submittal as parts of the DCD.
  - ✓ Most of the detailed standard design will be completed during the DCD review phase.
  - ✓ DAC will be limited to the Class 3 piping and to plant specific areas of I & C and HFE design.
- "Security Assessments" will be separately provided to support Chapter 13 of the DCD prior to COLA submittal.
- MHI makes efforts to closely communicate with the NRC staffs to optimize the review process.
- It is expected that the MHI's licensing plan meets the NRC's review plan.
- We would like the NRC's feedback on our approach.