

UAP-HF-06035

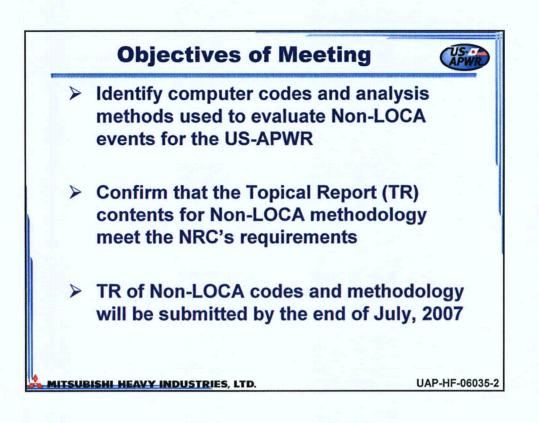
US-APWR

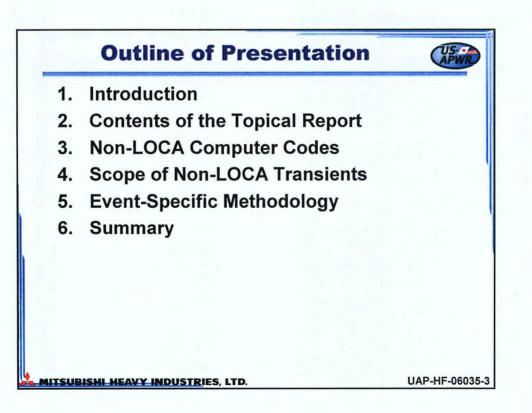
4th Pre-Application Review Meeting Non-LOCA Methodology

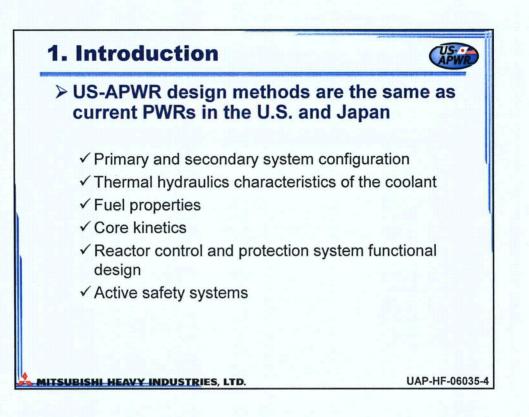
> February 1, 2007 Mitsubishi Heavy Industries, Ltd.

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Meeting Attendees Makoto Toyama (Responsible for Safety Analysis for US-APWR) **General Manager Reactor Safety Engineering Department** Nuclear Energy Systems Engineering Center Mitsubishi Heavy Industries, LTD. Hisanaga Takahashi (Responsible for Non-LOCA Safety Analysis) **Engineering Manager** Safety & Licensing Integration Group Nuclear Energy Systems Engineering Center Mitsubishi Heavy Industries, LTD. Junto Ogawa (Responsible for Non-LOCA Code & Methodology) Acting Manager Reactor Control & Protection System Engineering Section Nuclear Energy Systems Engineering Center Mitsubishi Heavy Industries, LTD. UAP-HF-06035-1 MITSUBISHI HEAVY INDUSTRIES, LTD.

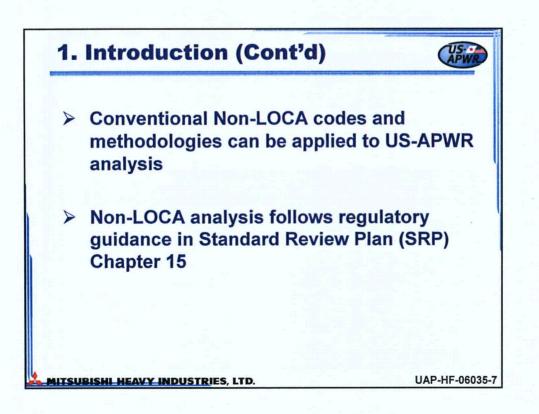


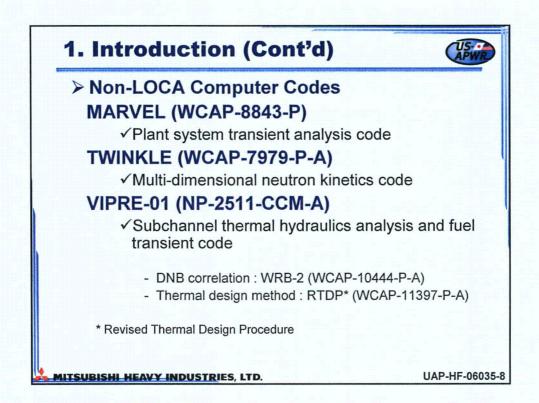


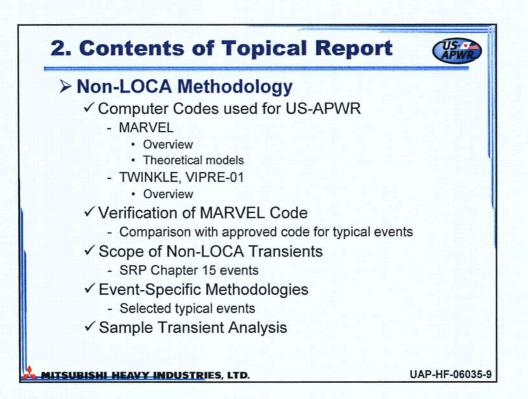


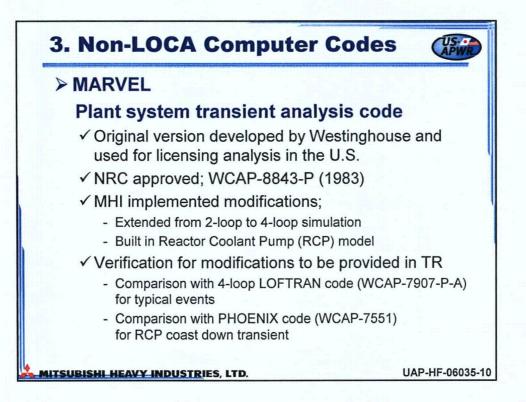
. Introduction (Co	ont'd)	Ċ	
 US-APWR Plant Parameter Summary Large core thermal output Large thermal margins due to the lower average linear heat rate 			
Features	US-APWR	US Current 4 Loop Plant	
Core thermal output (MWt)	4,451	3,565	
Number of loops, SGs and RCPs	4	4	
Number of fuel assemblies	257	193	
Fuel rod lattice	17 x 17	17 x 17	
Active fuel length (ft)	14	12	
Average linear heat rate (kW/ft)	4.6	5.7	
Reactor coolant pump type	Centrifugal	Centrifugal	
reactor coolant punip type	24 ·····		

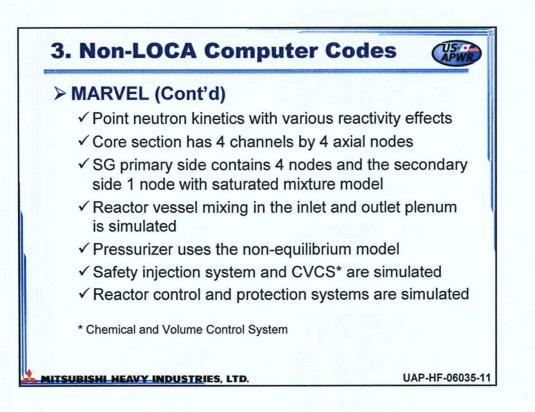
	Design Features lar to current U.S. PWRs
Features	Effects on Non-LOCA Analysis
Neutron Reflector	Negligible change on point kinetics parameters
Simplified core	Core inlet mixing between loops approximately the same
Pressurizer	Larger steam space moderates pressure transients
Steam generator	Smaller U-tube diameter improves the SGTR*1 transient
FWS*2	4 separate trains with 1 pump in each loop
Digital reactor protection system	Similar to newer U.S. operating plants
Diverse actuation system	Addresses design requirements for ATWS*3
Advanced Accumulator	Not expected to actuate in Non-LOCA analysis

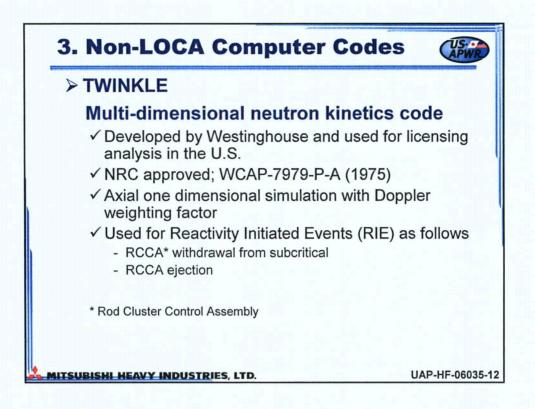


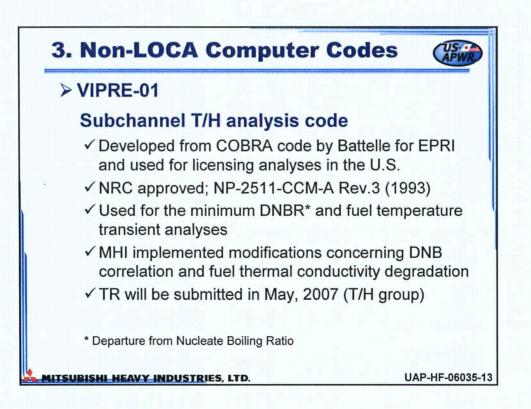


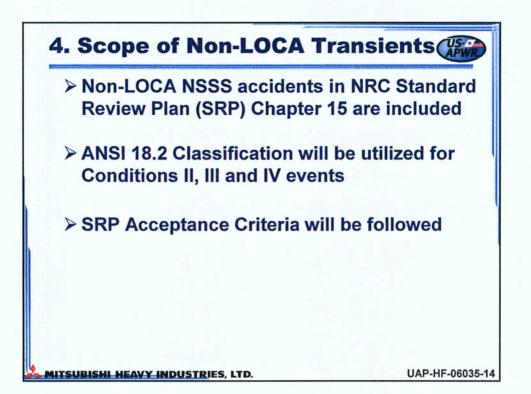












 SRP Chapter 15 Events, Classific 1. Increase in Heat Removal from the second seco		-
Faults	Class.	Computer codes
(1) Feedwater system malfunctions causing a reduction in feedwater temperature	Cond.II	MARVEL
(2) Feedwater system malfunctions causing an increase in feedwater flow	Cond.II	MARVEL
(3) Excessive increase in secondary steam flow	Cond.II	MARVEL
(4) Inadvertent opening of a steam generator relief or safety valve	Cond.II	MARVEL, VIPRE-01*1
(5) Steam system piping failure	Cond.III*2 Cond.IV*3	MARVEL, VIPRE-01*1
*1 Steady state analysis *2 Minor breaks *3 Major breaks		
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4. Scope of Non-LOCA Transients

> SRP Chapter 15 Events, Classification, Computer Codes

2. Decrease in Heat Removal by the Secondary System

Faults	Class.	Computer codes
(1) Loss of external electrical load and/or turbine trip	Cond.II	MARVEL
(2) Inadvertent closure of main steam isolation valves	Cond.II	MARVEL
(3) Loss of condenser vacuum and other events resulting in turbine trip	Cond.II	MARVEL
(4) Loss of non-emergency ac power to the station auxiliaries	Cond.II	MARVEL
(5) Loss of normal feedwater flow	Cond.II	MARVEL
(6) Feedwater system pipe break	Cond.IV	MARVEL

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4. Scope of Non-LOCA Transients

SRP Chapter 15 Events, Classification, Computer Codes
 3. Decrease in Reactor Coolant System Flow Rate

Faults	Class.	Computer codes
(1) Partial loss of forced reactor coolant flow	Cond.II	MARVEL, VIPRE-01
(2) Complete loss of forced reactor coolant flow	Cond.III	MARVEL, VIPRE-01
(3) Reactor coolant pump shaft seizure (locked rotor)	Cond.IV	MARVEL, VIPRE-01
(4) Reactor coolant pump shaft break	Cond.IV	MARVEL, VIPRE-01

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4. Scope of Non-LOCA Transients

> SRP Chapter 15 Events, Classification, Computer Codes

4. Reactivity and Power Distribution Anomalies

Faults	Class.	Computer codes
(1) Uncontrolled RCCA bank withdrawal from a subcritical or low power startup condition	Cond.II	TWINKLE, VIPRE-01
(2) Uncontrolled RCCA bank withdrawal at power	Cond.II	MARVEL
(3) RCCA misalignment (Dropped RCCA, Statically misalignment and Withdrawal of a single RCCA)	Cond.II Cond.III	MARVEL VIPRE-01*1
(4) Startup of an inactive reactor coolant pump at an incorrect temperature	Cond.II	N-1 loop operation not allowed
(5) CVCS ^{*2} malfunction that results in a decrease in the boron concentration in the reactor coolant	Cond.II	Evaluation without computer code
(6) Spectrum of RCCA ejection accidents	Cond.IV	TWINKLE, VIPRE-01
*1 Steady state analysis *2 Chemical and Volume Control System		
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4. Scope of Non-LOCA Transients

> SRP Chapter 15 Events, Classification, Computer Codes

5. Increase in Reactor Coolant Inventory

Faults	Class.	Computer codes
(1) Inadvertent operation of the emergency core cooling system during power operation	Cond.II	N/A*1
(2) CVCS* ² malfunction that increases reactor coolant inventory	Cond.II	MARVEL

*1 Not Applicable - Safety Injection pump shut off head below normal operation pressure *2 Chemical and Volume Control System

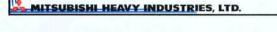
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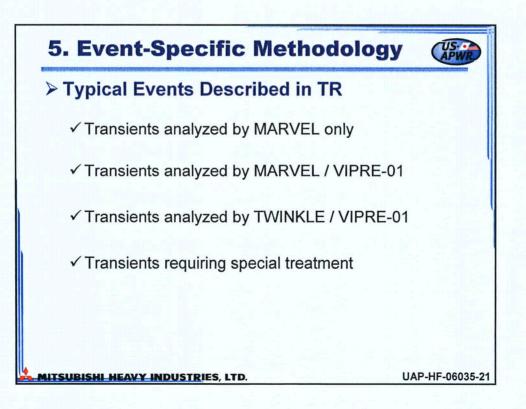
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4. Scope of Non-LOCA Transients

SRP Chapter 15 Events, Classification, Computer Codes
 6. Decrease in Reactor Coolant Inventory

Faults	Class.	Computer codes
(1) Inadvertent opening of a pressurizer safety valve	Cond.II	MARVEL
(2) Steam generator tube rupture	Cond.IV	MARVEL





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