MITSUBISHI HEAVY INDUSTRIES, LTD.

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TOKYO, JAPAN

June 21, 2012

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-12169

Subject: MHI's Response to US-APWR DCD RAI No. 922-6409 Revision 3 (SRP 10.04.08)

Reference: 1) "Request for Additional Information No. 922-6409 Revision3, SRP Section 10.04.08 –Steam Generator Blowdown System: 10.4.8", dated April 18, 2012.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Response to Request for Additional Information No. 922-6409 Revision 3 (SRP 10.04.08)."

Enclosed is the response to the question contained within Reference 1.

Please contact Mr. Joseph Tapia, General Manager of Licensing Department, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
Director- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Response to Request for Additional Information No. 922-6409 Revision 3 (SRP 10.04.08)

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-12169
Docket No. 52-021

Response to Request for Additional Information No. 922-6409
Revision 3 (SRP 10.04.08)

June 2012

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

06/21/2012

US-APWR Design Certification
Mitsubishi Heavy Industries
Docket No. 52-021

RAI NO.:	**NO.922-6409 REVISION 3**
SRP SECTION:	**10.04.08 – Steam Generator Blowdown System**
APPLICATION SECTION:	**DCD Sections 10.4.8**
DATE OF RAI ISSUE:	**4/18/2012**

QUESTION NO. : 10.04.08-12

The staff requests that the applicant identify the design conditions for the steam generator blowdown system and how the changes made between Rev. 2 and Rev. 3 of the DCD affect the design margin. The applicant's December 12, 2011, response, to RAI 862-6165, Question 10.04.08-10 stated that the initial design (DCD Rev. 0 through Rev. 2) assumed 10% steam generator (SG) tube plugging. The response also implies that the design in DCD Rev. 3 does not assume 10% SG tube plugging. Some changes to the design parameters, such as reduced heat exchanger design heat duty and design flow rate, appear to reduce the design margin. Since the plant is likely to operate with some percentage of the SG tubes plugged, and since some changes appear to reduce the design margin, the basis for these changes remains unclear to the staff.

ANSWER:

In DCD Rev. 2 and Rev. 3, Table 10.4.8-1 misrepresents various operating parameters as design parameters. Attachment 1 revises Table 10.4.8-1 to correctly reflect the operating and design parameters of the Steam Generator Blowdown System (SGBDS) major components.

There have been no SGBDS design parameter changes from DCD Rev. 2 to Rev. 3; only operating parameter changes have occurred. These changes are the result of the secondary system design being further developed. The operating parameters which changed from DCD Rev. 2 to Rev. 3 are shown in the table below.

The changes in operating parameters result in no margin decreases. Tube side flow rates in the SGBD regenerative heat exchangers and non-regenerative coolers changed as a result of the progression in secondary system design. This has lead to the reduction in operating heat duties and shell side flow rates of the aforementioned components. These changes represent an increase in design margin due to the heat duty of the components being reduced while their designed thermodynamic capacities remain the same. Similarly, flow rates of the demineralizer inlet filters and demineralizers have decreased while the demineralizers' resin volumes have been maintained, thereby increasing the purification capacity of the demineralizers.

SGBD Flash Tank	Rev.2	Rev.3	Rev.3-Rev.2
Capacity (ft^3)	300	370	70
SGBD Regenerative HX			
Operating Flow Rate Shell(lb/hr)	73,500	72,700	-800
Operating Flow Rate Tube(lb/hr)	79,400	78,400	-1,000
Operating Heat Duty (Btu/hr)	17,600,000	17,400,000	-200,000
SGBD Non-Regenerative Cooler			
Operating Flow Rate Shell(lb/hr)	397,000	392,000	-5,000
Operating Flow Rate Tube(lb/hr)	79,400	78,400	-1,000
Operating Heat Duty (Btu/hr)	3,570,000	3,520,000	-50,000
SGBD Demi			
Operating Flow Rate (gpm)	320	316	-4
SGBD Demi Inlet Filter			
Operating Flow Rate (gpm)	320	316	-4

Impact on DCD

Section 10.4.8.2.3 and Table 10.4.8-1 have been revised as shown in Attachment-1.

Impact on R-COLA

The R-COLA is impacted by this change.

Impact on S-COLA

The S-COLA is impacted by this change.

Impact on PRA

There is no impact on the PRA

Impact on Topical Report / Technical Report

There is no impact on the Topical Report / Technical Report

10.4.8.2.3 Component Description

Component design and key operating parameters are provided in Table 10.4.8-1. The US-APWR SG Blowdown system design specifies low-alloy steel and stainless steel for most of the piping and components in order to preclude the need for the application of the FAC monitoring program. For any portion of the piping and /or components that are made of carbon steel, the SGBDS relies on the control of the water chemistry as described in DCD Subsection 10.3.5, Water Chemistry. This control minimizes the potential for flow accelerated corrosion in the carbon steel piping and/or components. In addition, for the carbon steel lines and components, the FAC monitoring program will be conducted, which includes the inspection of the wall thickness of carbon steel piping and/or components and replacement if required. The FAC monitoring program is a COL item, (see the FAC monitoring program COL Item 10.3 (1) in Chapter 10.3.2). DCD_10.04.08-12

1. **SG blowdown Flash Tank**

   SG blowdown flash tank is located in the T/B. During normal operation, maximum 1% MSR at rated power blowdown water is separated into flashing vapor and saturated liquid in this tank by lowering pressure and temperature in this tank.

2. **SG blowdown regenerative heat exchangers**

   SG blowdown regenerative heat exchangers are located in the T/B. Two-50 percent capacity blowdown regenerative heat exchanger trains are provided. Blowdown water from the flash tank is cooled in the regenerative heat exchanger(s) by the the condensate from the CFS to recover thermal energy from the blowdown water. The heated condensate is discharged into the deaerator.

3. **SG blowdown non-regenerative coolers**

   SG blowdown non-regenerative coolers are located in the T/B. Two-50 percent capacity non-regenerative blowdown cooler trains are provided. Blowdown water from the regenerative heat exchanger discharge flows to non-regenrative cooler(s) and is cooled by the cooling water from the TCS.

4. **SG blowdown filters**

   SG blowdown filters are located in the auxiliary building, ahead of SG blowdown demineralizers. These filters remove impurities from the blowdown water to protect the demineralizers. These filters consist of Two-100% capacity filters.

5. **SG blowdown demineralizers**

   SG blowdown demineralizers are located in the auxiliary building. The SG blowdown demineralizers purify the blowdown water during normal operation. The demineralizers consist of two cation beds and two mixed beds. Each bed has 100 percent ion exchange capability. Any cation bed can be used with any mixed bed.

Table 10.4.8-1 Steam Generator Blowdown System Major Component Design and Operating Parameters (Sheet 1 of 3) DCD_10.04.08-12

SG blowdown flash tank

Type	Vertical cylindrical	
Number of tanks	1	
Capacity (ft^3)	370	
~~Design~~Operating flow rate (lb/hr)	202,000 (1% of MSR at rated power)	DCD_10.04.08-12
Design pressure (psig)	300	
Design temperature (°F)	410	
Materials of construction	Stainless steel	

SG blowdown regenerative heat exchangers (per heat exchanger)

Type	Shell and tube		
Number of exchangers	2		
~~Design~~Operating heat duty (Btu/hr)	$17.4x10^6$		DCD_10.04.08-12
Operating conditions	Tube side	Shell side	
Fluid	SG blowdown water	Condensate	
Operating temperature - In (°F)	375	129	
- Out (°F)	158	365	
~~Design~~Operating flow rate (lb/hr)	$78.4x10^3$	$72.7x10^3$	DCD_10.04.08-12
Design pressure (psig)	300	560	
Design temperature (°F)	410	410	
Materials of construction	Stainless steel	Carbon steel	

SG blowdown non-regenerative coolers (per cooler)

Type	Shell and Tube		
Number of coolers	2		
~~Design~~Operating heat duty (Btu/hr)	$3.52x10^6$		DCD_10.04.08-12
Operating conditions	Tube side	Shell side	
Fluid	SG Blowdown Water	TCS	
Operating temperature - In (°F)	158	100	
- Out (°F)	113	109	
~~Design~~Operating flow rate (lb/hr)	$78.4x10^3$	$392x10^3$	DCD_10.04.08-12
Design pressure (psig)	300	200	
Design temperature (°F)	200	200	
Materials of construction	Stainless steel	Carbon steel	

Table 10.4.8-1 Steam Generator Blowdown System Major Component Design and Operating Parameters (Sheet 2 of 3)

DCD_10.04.08-12

SG blowdown demineralizers

Number of demineralizers	4 (two cation bed and two mixed bed)
Resin amount (ft^3)	230
~~Design~~Operating flow rate (gpm)	316
Design pressure (psig)	300
Design temperature (°F)	200
Materials of construction	stainless steel

DCD_10.04.08-12

SG blowdown sample coolers

Type	Double tube	
Number of coolers	4	
~~Design~~Operating heat duty (Btu/hr)	209×10^3	
Operating conditions	Tube side	Shell side
Fluid	Blowdown water	CCW
Operating temperature - In (°F)	557	100
- Out (°F)	113	128
~~Design~~Operating flow rate (lb/hr)	440	7,500
Design pressure (psig)	1185	200
Design temperature (°F)	568	200
Materials of construction	stainless steel	carbon steel

DCD_10.04.08-12

DCD_10.04.08-12

SG blowdown demineralizers inlet filters

Type	Vertical cylindrical, cartridge
Number of filters	2
Operating flow rate (gpm)	316
Operating temperature (°F)	113
Design pressure (psig)	300
Design temperature (°F)	200
0.8 micron particles retention (%)	98
Material of construction, filter	Polyproplyene
Body	Stainless steel

Table 10.4.8-1 Steam Generator Blowdown System Major Component Design and Operating Parameters (Sheet 3 of 3) DCD_10.04.08-12

SG blowdown isolation valves

Number of valves	8
Type	Air-operated globe
Nominal valve size (inch)	4
Design pressure (psig)	1,185
Design temperature (°F)	568
Material of construction, body	Stainless steel
Construction Code, First valve	ASME Section III, Class 2
	Seismic Category I
Second valve	ASME Section III, Class 3
	Seismic Category I

SG blowdown sample line containment isolation valves

Number of valves	4
Type	Air-operated globe
Nominal valve size (inch)	3/4
Design pressure (psig)	1,185
Design temperature (°F)	568
Material of construction, body	Stainless steel
Construction Code	ASME Section III, Class 2
	Seismic Category I