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TOKYO, JAPAN

November 7, 2008

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-08254

Subject: MHI's Response to US-APWR DCD RAI No.83-1007 Revision 0

Reference: 1) "Request for Additional Information No. 83-1007 Revision 0, SRP Section: 06.05.03, Application Section: 6.5.3" dated October 8, 2008.

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. 83-1007 Revision 0."

Enclosed is the response to one RAI contained within Reference 1.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is below.

Sincerely,

Y. Ogata

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

Enclosure:

1. Response to Request for Additional Information No. 83-1007 Revision 0

CC: J. A. Ciocco
C. K. Paulson

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NRO

Enclosure 1

UAP-HF-08254
Docket Number 52-021

Response to Request for Additional Information
No. 83-1007 Revision 0

November, 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

11/07/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.83-1007 REVISION 0**
SRP SECTION:	**06.05.03 – FISSION PRODUCT CONTROL SYSTEMS AND STRUCTURES**
APPLICATION SECTION:	**SRP 6.5.3**
DATE OF RAI ISSUE:	**10/08/2008**

QUESTION NO. : 06.05.03-2

It is not clear how the spray water will dissolve NaTB from the baskets, and how it will mix with the water in the RWSP to achieve pH > 7. Please, provide details on:

A. the NaTB baskets are located in the periphery of the containment (near the outside wall), and only spray water from Ring D can reach these baskets. What happens if this ring D does not operate or partially operates? Some baskets may not be reached by spray. And how the distribution of 23 baskets into three groups/containers was selected?

B. the NaTB dissolution, transport and mix with the rest of the RWSP water is a function of time. Please, discuss the effect of non-uniform NaTB distribution, including potential entrapment of NaTB in dead-ended areas of the containment.

C. provide supporting calculation of pH being >7, given the NaTB of 44,100 lbs and boric acid being dissolved in the maximum RWSP water inventory.

ANSWER:

A-1
It is not assumed that the ring D does not operate or partially operate during accident. The basis is described as follows:

Spray rings of US-APWR is designed as one-header as Figure 1, therefore, each spray ring would not be unavailable by any single active failure in Containment Spray System (CSS).
For single passive failure, leakage owing to failure of a pump or a valve seal is assumed but a pipe break is not assumed based on SECY-77-439 (Reference 1). In case of

single passive failure in containment, it is not necessary to assume any concurrent single active failure, therefore, more than three containment spray/residual heat removal pumps would operate. The required spray flow rate is accomplished by operating of two pumps, thus, the required function for CSS is accomplished in case of leakage in containment. If a single passive failure occurs outside of containment, affected CSS train is isolated.

Reference 1 : SECY-77-439, "Single Failure Criterion"

A-2
NaTB baskets are distributed in three containers based on concern for layout design. Because spray nozzles are arranged evenly, there is not any functional limitation for number of baskets or circumferential location of containers.

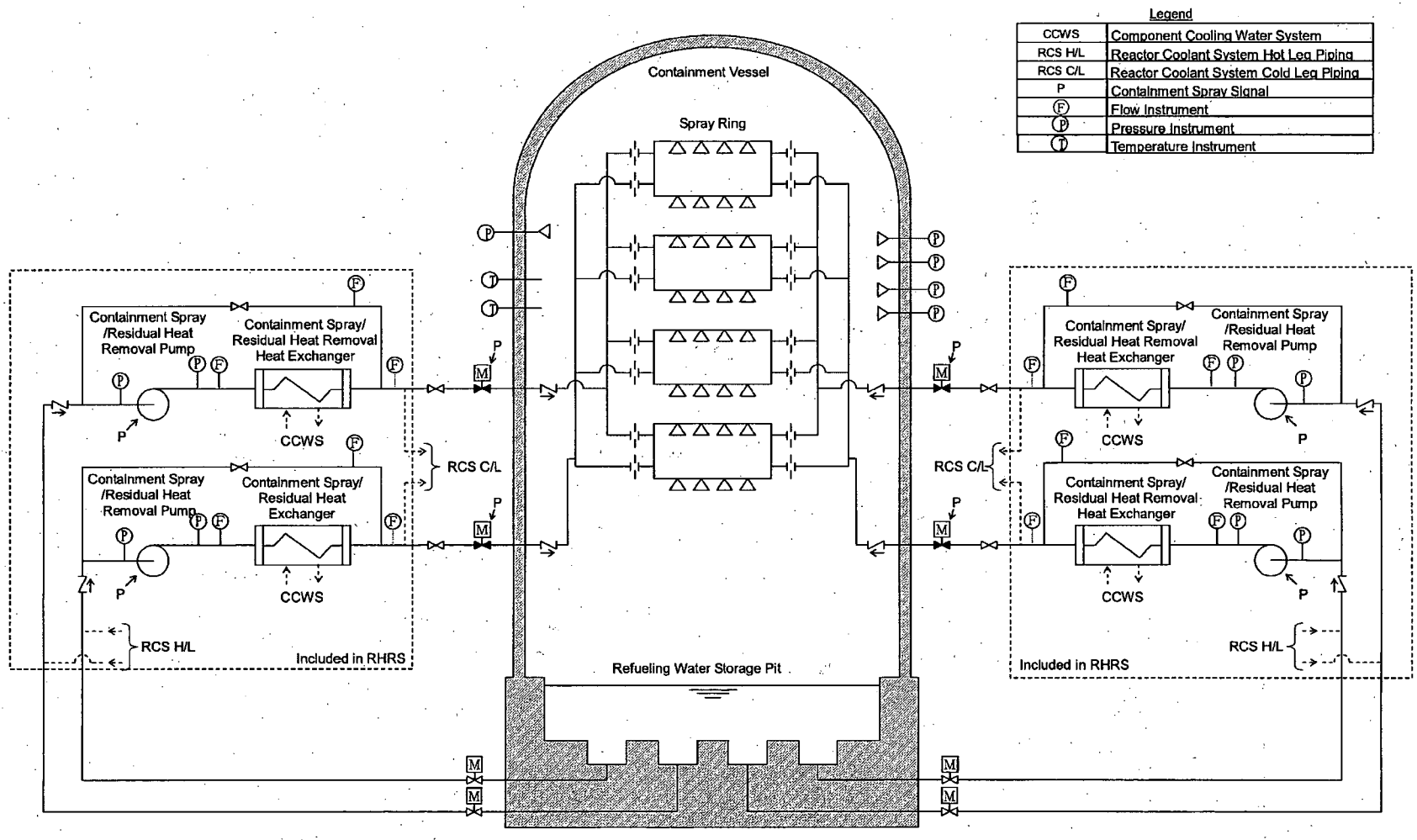

Figure -1 Containment Spray System

B.
The quantity of NaTB is decided based on the whole boric-acid water (including boric-acid water trapped in dead-ended area) in containment vessel following an accident as described in the answer to question C.

Additionally, the following design provision is taken to prevent NaTB from being trapped in dead-ended area and eventual insufficient concentration of NaTB in Refueling Water Storage Pit (RWSP):

(1) NaTB transfer piping is provided from NaTB container to RWSP to allow direct discharge of dissolved NaTB in basket container to RWSP.

(2) If NaTB solution in basket container overflows from container, NaTB solution of high concentration is potential to be trapped in dead-ended area in containment. NaTB transfer piping is sized large enough to ensure the direct transfer of NaTB solution to RWSP without being filled with solution in piping and resulting overflow from container. (Refer to Figure 2.)

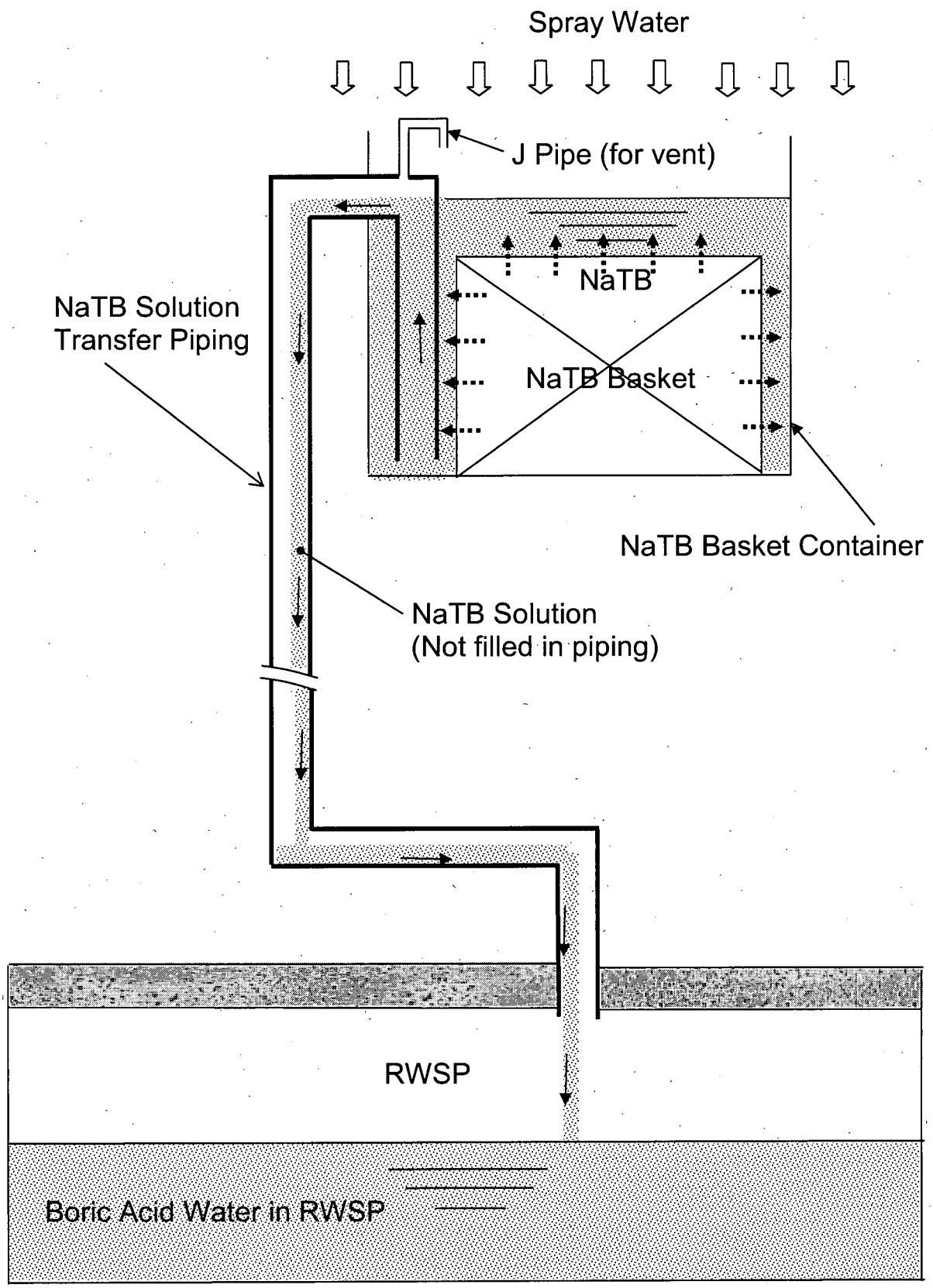

Figure 2 Schematic Diagram of NaTB Solution Transfer to RWSP

C.
NaTB quantity contained in the baskets is decided as summation of the quantity for neutralizing both of boric-acid water and acid formed after accident occurrence.

(1) Neutralization of boric-acid water
Each source of boric-acid water used to calculate the necessary NaTB quantity is as follows:

Water Source	Volume (gallon)	Note
Accumulators(ACCs)	79,250	(Total tank volume- gas volume)x 4
RWSP	665,760	Maximum volume during normal operating
RCS	134,730	
Total	879,740	

The boron concentration of total boric-acid water volume in ACCs, RWSP, and RCS , 879,740 gallon (3.33 x 10^6 liter) is assumed as 4200 ppm which is maximum boron concentration of ACCs and RWSP water specified in Technical Specification. (Boron concentration of RCS water is conservatively assumed to be 4200 ppm), and required NaTB quantity to achieve pH7 is calculated.

Figure 3 shows the relation between boron concentration of boric-acid water and NaTB weight required for neutralizing. Figure 3 was made based on titration. From Figure 3, the amount of NaTB additive required to neutralize 1 liter of boric-acid water with 4200 ppm of boron concentration is 5.2 gram.

Consequently, the amount of NaTB additive required to achieve pH7 is 38,100 lb (17.32 ton) as follows:

$$5.2g/\ell \times 3.33 \times 10^6 \ell = 1.732 \times 10^7 g(38{,}180lb)$$

(2) Neutralization of acid formed after accident occurrence
Acid is formed under the influence of radiation during accident, that is, chlorine contained in jackets covering the insulation cables inside the containment undergoes radiolysis to generate hydrochloric acid. Also nitrogen dissolved in water produces nitric acid due to radiolysis. Generation of these acids due to radiolysis is based on NUREG-1081 and NUREG/CR-5950. For the largest inventory of 879,740 gal(3.33 x 10^6 liter) of water, 2.5 E-03 mol/gal (=6.5 E-04 mol/l) of hydrochloric acid and 2.1 E-03 mol/gal (= 5.4 E-04 mol/l) of nitric acid are formed after 30 days. The amount of NaTB necessary to neutralize these acids thus formed is 1,740 lb (=0.79 tons).

(3) Required NaTB Additive Quantity
From (1) and (2) above, the weight of NaTB contained in baskets is 44,100 lb (20ton), which is as following with margin, and pH of RWSP water following an accident is greater than 7.

38,180lb (17.32ton) +1,740lb (0.79ton) =39,920lb (18.11ton)

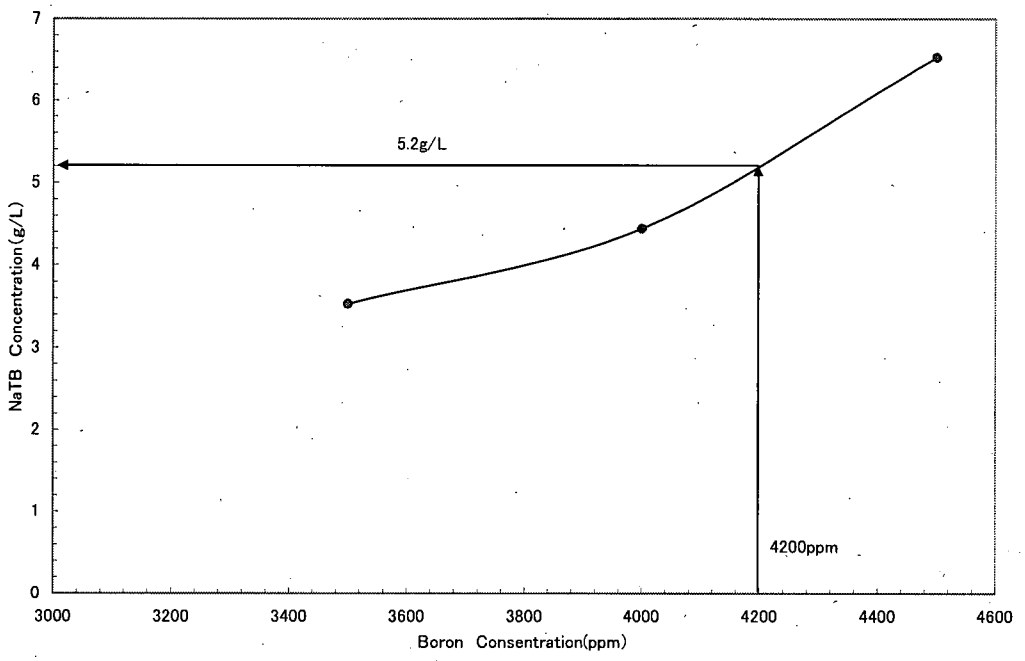

Figure 3 NaTB Concentration Required to Neutralizing Boric-Acid Water

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.