MITSUBISHI HEAVY INDUSTRIES, LTD.
16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

August 31, 2011

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-11280

Subject: **MHI's Amended Response to US-APWR DCD RAI No. 740-5719 Revision 2 (SRP 06.02.02)**

Reference: [1] "Request for Additional Information No. 740-5719 Revision 2, SRP Section: 06.02.02 – Containment Heat Removal System –Application Section: 6.2." dated April 26, 2011.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Amended Response to Request for Additional Information No. 740-5719 Revision 2".

Enclosed is the response to Question 06.02.02-64 that is 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.

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NRO

Enclosures:

1. Amended Response to Request for Additional Information No. 740-5719 Revision 2

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

Contact Information
C. Keith Paulson, Senior Technical Manager
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146
E-mail: ck_paulson@mnes-us.com
Telephone: (412) 373-6466

Enclosure 1

UAP-HF-11280
Docket No. 52-021

Amended Response to Request for Additional Information No. 740-5719 Revision 2

August 2011
(Non-Proprietary)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

8/31/2011

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

RAI NO.:	**NO. 740-5719 REVISION 2**
SRP SECTION:	**06.02.02 – Containment Heat Removal System**
APPLICATION SECTION:	**6.2**
DATE OF RAI ISSUE:	**4/26/2011**

QUESTION NO.: 06.02.02-64

On April 7th, 2011, the staff performed an audit of 4CS-UAP-20070029 Rev1, "Hold-up Water volume calculation sheet during LOCA" describing the calculation of hold-up water volume following a loss of coolant accident to be used in determining the NPSH available for safety related pumps that draw suction from the RWSP. Describe how this calculation was conservative for the NPSH evaluation. Include the following considerations.

a. The NaTB baskets and associated drain piping were not discussed in the hold-up volume calculation.
It appears that they should be as they are designed to collect spray water and then deliver flow to the RWSP.

b. Appropriate reference and justification should be provided for the applied methodology and selected input values used in the hold-up water calculation to demonstrate how the hold-up amount is conservative from a NPSH perspective. The following areas require additional information:

o Containment spray water droplets – Amount of water is a function of flow volume, fall height, and fall time. Method used for evaluating the fall time did not consider atmospheric resistance. This method under-predicts the fall time and therefore the spray water hold-up in the atmosphere. In addition, the flowrate and fall height values selected were not referenced to a document nor was a description provided that explained why the selected values were conservative for calculating hold-up amounts. Please explain how the treatment of spray water droplets in your calculation will provide conservative results.

o Condensate water on containment surfaces – Equation listed for film condensation correlation used to calculate film thickness could not be readily verified (reference in Japanese) and was not found in standard textbooks on heat and mass transfer. Appropriate reference and justification should be provided for the applied methodology and selected input values. Film thickness will be a function of the surface height. Justify estimated vertical surface area and corresponding heights used in the calculations.

o Vapor in the containment atmosphere – No basis provided for vapor amount assumed in the hold-up analysis. Please provide the reference and basis for the atmospheric conditions used to calculate the vapor amount.

o Water retained on the floors – Reference and basis was not provided for selected equation (method of evaluation) or input values used to evaluate dynamic retention on containment floor (result was 6" water height above floor). No evaluation was provided for assessing the dynamic retention on upper floors in containment (assumed 2" height above floor). Please provide the reference and basis and for calculating the dynamic water retention heights to include method and input values.

c. Describe how the volume of water in the reactor system and the volume of water re-injected into the reactor system from the safety injection system is evaluated.

d. Provide a proposed ITAAC for inspection of the as built containment. The purpose of the inspection is to confirm that all potential water retention locations have been identified and the amount of water retention has been conservatively estimated for each potential location.

e. Provide a correlation to permit converting RWSP water volume (gallons) to RWSP water level (feet).

ANSWER:

a. Holdup volume of NaTB baskets and associated drain piping

The holdup volume in the NaTB baskets and associated drain piping was not included in the total “Holdup Volume,” which was not conservative for the $NPSH_A$ evaluation.

The calculated water volume for the NaTB baskets is listed below. The calculation shall be revised to account for the NaTB basket and piping volumes in the total “Holdup Volume”.

- NaTB baskets: 21,010 gallons (Ineffective Pool)
- Associated drain piping: 1,190 gallons (Return Water on the Way to RWSP)

The “Ineffective Pool” and “Return Water on the Way to RWSP” volume in DCD Table 6.2.1-3 will be revised to reflect this increase of 21, 010 and 1,190 gallons, respectively.

b. Clarification of holdup water calculations and related references

- Containment spray water droplets

  Terminal velocity of the containment spray droplets was re-calculated under the following assumptions for the accident fluid condition in the containment with different elevations. They are described in Table b-1. As a result, calculated fall times in the containment atmosphere above the operating floor are approximately

10 sec to 25 sec with a consideration of atmospheric resistance as a function of Reynolds number.

Spray droplet terminal velocity and fall time in the containment dome atmosphere were calculated in the following manner.

For the transition and turbulent region ($500 < Re < 1.0 \times 10^5$), the resistance coefficient for a spherical shape is defined as:

$C_D = 0.44$ (Ref. 1)

Since Re for this calculation case is above 500, terminal velocity can be calculated as follows,

$$m\frac{dv}{dt} = mg - D$$

where m is the droplet mass for one particle, v is particle velocity, D is resistance force and g is gravitational acceleration. D can be described from Stokes law with C_D for the transition and turbulent region as

$$D = \frac{1}{2}C_D \rho v^2 S = 0.22\rho\pi r^2 v^2$$

where ρ is the containment atmospheric density, μ is viscosity and S is particle surface area (cross section normal to velocity).

Terminal velocity v can be derived from the above equations by assuming free fall as:

$$v = \sqrt{\frac{mg}{0.22\rho\pi r^2}}\ .$$

Then, the fall time t for the transition and turbulent regions ($C_D = 0.44$) can be solved for different elevations shown in Table b-1.

For the fall time calculation, since it takes little time for the droplet to reach terminal velocity, it is possible to simply apply the C_D for the transition and turbulent regions and neglect C_D for the laminar region. Based on the obtained fall times (about 16 seconds to operating floor and about 20 seconds to refueling cavity floor), total spray water droplet volume was calculated to be about 2,640 gallons.

The corresponding spray water droplet volume was about 660 gallons in the original calculation (neglecting terminal velocity). Therefore, consideration of terminal velocity increases the total spray water droplet volume by about 1,980 gallons.

The "Return Water on the Way to RWSP" volume in DCD Table 6.2.1-3 will be revised to reflect this increase of 1,980 gallons.

Table b-1 Calculation Assumptions

Parameter	Description	Value
Spray Droplet Shape	Sphere	N/A
Spray Droplet Diameter	Constant to Sauter mean diameter	1,000 micro meters (Ref. 2)
Initial Speed	Not Considered	0
Spray Nozzle Level	Highest level of spray nozzle	EL 224'-5"
Floor Level	Operating floor	EL 76'-5"
	Refueling cavity floor	Each refueling cavity floor level (EL 46'-11" etc.)
Containment Atmosphere Fluid Condition	LOCA Peak Pressure/Temperature (Mixture of steam, air and nitrogen released from accumulator)	74.2 psia 284 °F (Ref. 3)

- Condensate water on containment surfaces

Condensate film thickness was calculated from Eq. 11 in the holdup volume calculation based on the fluid conditions. The calculation follows the methodology of theoretically solving the Nusselt film heat transfer correlation, which is widely known and is referenced from Reference 4 and 5.

The steps of deriving Eq. 11 are shown as follows:

Assume constant condensation and liquid flow on structure surfaces (Figure b-1).

Mass Conservation

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}=0 \qquad \text{(Eq. 1)}$$

Momentum Conservation

$$\rho_L u\frac{\partial u}{\partial x}+\rho_L v\frac{\partial u}{\partial y}=\mu_L\frac{\partial^2 u}{\partial y^2}+g(\rho_L-\rho_v)\sin\varphi \qquad \text{(Eq. 2)}$$

Energy Conservation

$$c_{pL}\rho_L u\frac{\partial\theta}{\partial x}+c_{pL}\rho_L v\frac{\partial u}{\partial y}=\lambda_L\frac{\partial^2\theta}{\partial y^2} \qquad \text{(Eq. 3)}$$

Where:

u : Liquid velocity for y axis (horizontal)
v : Liquid velocity for x axis (vertical)
ρ_L : Liquid film density
μ_L : Liquid film viscosity
ρ_v : Vapor (steam) density
φ : Heat structure surface angle from horizontal (90°)
c_{pL} : Liquid film heat capacity
θ : Temperature
λ_L : Liquid film heat conductivity

Boundary conditions are as follows:

u=v=0 and θ=θ$_W$ at y=0 (structure surface),

$\mu_L \frac{\partial u}{\partial y} = 0$ and θ=θs at y=δ (film surface) (Eq. 4)

Where

θ$_w$: Structure surface temperature

θ$_s$: Film surface temperature

Additionally, assuming thermal equilibrium from x=0 to x=x in the liquid film at steady state and condensation latent heat L, energy balances can be written as follows:

$$L\int_0^\delta \rho_L u dy + L\int_0^\delta \rho_L u c_{pL}(\theta s - \theta) dy = \int_0^x \lambda_L \left(\frac{\partial \theta}{\partial y}\right)_{y=0} dx$$

Simplifying gives:

$$L\rho_L \int_0^\delta u\left\{1 + \frac{c_{pL}(\theta s - \theta)}{L}\right\} dy = \lambda_L \int_0^x \left(\frac{\partial \theta}{\partial y}\right)_{y=0} dx \qquad \text{(Eq. 5)}$$

Generally, $\frac{c_{pL}(\theta s - \theta)}{L}$ is much smaller than 1 and thus the thermal conductance in the liquid film can be ignored. This further simplifies Eq. 5 to:

$$L\rho_L \int_0^\delta u dy = \lambda_L \int_0^x \left(\frac{\partial \theta}{\partial y}\right)_{y=0} dx \qquad \text{(Eq.6)}$$

Applying the same assumption to Eq.3, $\frac{\partial^2 \theta}{\partial y^2}$ can be considered very small and therefore assumed to be zero. Integrating Eq. 3 (with $\frac{\partial^2 \theta}{\partial y^2}$ set to zero) and considering boundary conditions, temperature distribution in the liquid film is given as:

$$\theta = \theta_W + (\theta_S - \theta_W)\frac{y}{\delta} \qquad \text{(Eq. 7)}$$

For the momentum conservation, neglecting the kinetic term and assuming no change in velocity (steady state) in Eq. 2, the following equation is obtained:

$$\mu_L \frac{\partial^2 u}{\partial y^2} = -g(\rho_L - \rho_v)\sin\varphi \qquad \text{(Eq. 8)}$$

With integration and boundary conditions, Eq.8 can be expressed as:

$$u = \frac{g(\rho_L - \rho_v)\sin\varphi}{2\mu_L}(2\delta y - y^2) \qquad \text{(Eq. 9)}$$

In order to obtain the liquid film thickness, combining Eq.7 and Eq. 8 with Eq. 6 gives:

$$\frac{\delta^3}{3} = \frac{c_{pL}(\theta_S - \theta_W)}{L} \frac{\nu_L \kappa_L}{g\left(\frac{\rho_L - \rho_V}{\rho_L}\right)\sin\varphi} \int_0^x \frac{dx}{\delta} \qquad \text{(Eq. 10)}$$

where ν is kinetic viscosity and κ is thermal conductivity of the liquid.

With an integration and boundary condition δ=0 at x=0, liquid film thickness is given by the following equation:

$$\delta = \sqrt{2}\left\{\frac{c_{pL}(\theta_S - \theta_W)}{L}\right\}^{\frac{1}{4}} \frac{1}{(Gr_x Pr_L)^{\frac{1}{4}}} x \qquad \text{(Eq. 11)}$$

Local heat transfer coefficient for film condensation is calculated from the well-known Nusselt equation which is obtained through the derivative of Eq. 7:

$$h_x = \frac{\lambda_L \left.\frac{\partial\theta}{\partial y}\right|_{y=0}}{\theta_S - \theta_W} = \frac{\lambda_L}{\delta}$$

and substitution into Eq.11:

$$Nu_x = \frac{h_x x}{\lambda_L} = \frac{1}{\sqrt{2}}\left\{\frac{L}{c_{pL}(\theta_S - \theta_W)}\right\}^{0.25} (Gr_x Pr)^{0.25}$$

By Eq.11, condensation liquid thickness on the surface of the heat structure is predicted. The height used for this calculation was 40 meters (about 130 feet), and the resulting condensation film thickness (based on 40 meters height) was applied to all surfaces. The vertical portion of containment from second floor level (EL 25'-3") is about 129 feet. If the vertical height (x) increases, the liquid film thickness also increases as shown in Eq. 11. However, the liquid thickness calculated based on a 40 meter height was conservatively applied to all surfaces.

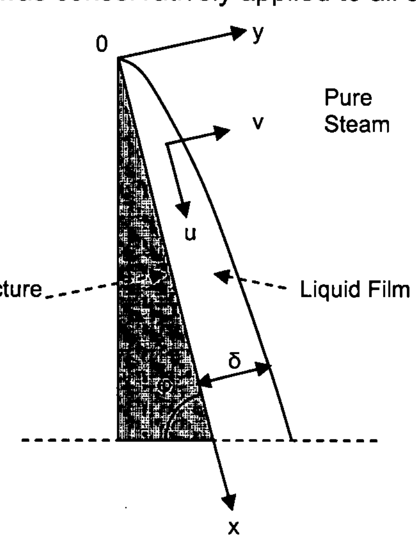

Figure b-1 Film Condensation at Structure Surface

The vertical surface area of the containment was calculated using "Concrete Outline Drawings" which indicate the frame shape of the building and the dimensions. Vertical area was extracted from the drawings, and a 5% margin was added to the total area.

There is no change to the previously calculated RWSP water volumes in Table DCD 6.2.1-3.

- Vapor in the containment atmosphere

  The vapor amount is calculated from conditions for the worst case pressure inside containment during a LOCA described in DCD Section 6.2.1. The calculation is based on Mass and Energy during a LOCA, as described in DCD Section 6.2.1.3 and Tables 6.2.1-18, 6.2.1-20 and 6.2.1-5 of the DCD and the assumption of minimum condensation volume as described in DCD Section 6.2.1, Tables 6.2.1-4 and 6.2.1-5.

  There is no change to the previously calculated RWSP water volumes in Table DCD 6.2.1-3.

- Water retained on the floors

  Water depth on the floors is calculated based on the following general expressions.

$$Q = CBh^{3/2} \qquad (1)$$

Where:
Q: Overflow volume
C: Flow coefficient
B: Width of curb
h: Overflow height

Overflow volume was calculated from pump flow rate. Conservatively, maximum flow rate is used considering 4 train SI and CS/RHR pump operation. Total flow rate per one transfer piping to be as follows;

Q = 1,540 gpm (SI pump) x 4 (train) + 2,450 gpm (CS/RHR pump) x 4 (train) / 10 (transfer piping number)
= 15,96 gpm
= 0.1007 m^3/sec

-Flow coefficient was calculated for the curb based on JIS (Japan Industrial Standards) B8302, 2002 "Measurement method of pump discharge" (Reference 7) and "Discharge Characteristics of Weirs of Finite Crest Width" written by Rao and Muralidhar (Reference 8) and to be as follows;

-C = 1.785 + 0.237 (h / W)
= 2.259

Where, W = 2 in ≈ 0.05 m (Curb height)
h = 0.1 m (Assumption value: overflow height)

Width of curb is designed to be approximately 600 mm (approximately 24 inches) as shown in Figure b-2. Width of curb shall be as follows;

$B = 0.6\ m \times \pi$
$= 1.885\ m$
$= 1.9\ m\ (\approx 75\ in)$

From equation (1) over flow height to be as follows;

$h = (Q / (C \times B))^{2/3}$
$= (0.1007 / (2.259 \times 1.9))^{2/3}\ m$
$= 0.082\ m$
$\approx 0.1\ m$ (Roundup)
$\approx 4\ in$

There is no change to the previously calculated RWSP water volumes in Table DCD 6.2.1-3.

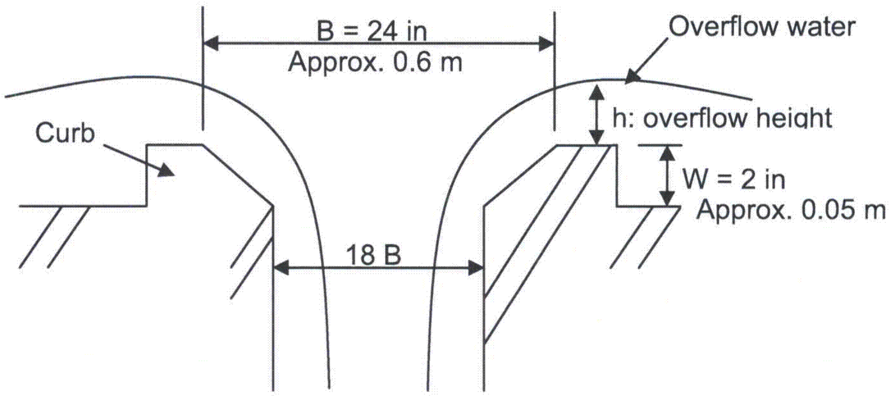

Figure b-2: Sketch of flooding overflow curb

c. Reactor system and re-injection water volume

Overall effect of RCS and re-injection water volumes is not included in the evaluation, for this assumption will provide conservative results for the following reason.

Following a LOCA, the reactor system water immediately begins to spill out from the pipe break section, and flows into the RWSP, raising its water level. Soon after this event, the water in the reactor vessel will be supplemented with the re-injected water by the ECCS. Although the re-injected water is sourced from the RWSP, that will not lower the RWSP water level, because the volume of the reactor system water that flows into the RWSP is clearly larger than that of re-injected water. Therefore, if we take the reactor system water and the re-injected water into account, the RWSP water level would be higher. Consequently, excluding these water volumes results in conservative evaluation of hold-up water in view of minimum water level calculation.

~~In the case of a LOCA, reactor system water will flow out from the pipe break section and the water will raise RWSP water level. In this evaluation, reactor system is~~

~~conservatively not taken into account for the holdup water volume calculation for the sump strainer head loss and $NPSH_A$ calculations.~~

~~Re-injection water, from RWSP intake piping through the Safety Injection Pump to the reactor system, replaces the water lost during a LOCA. Therefore, MHI neglected the re-injection water volume because it does not have an impact on the water volume calculation.~~

There is no change to the previously calculated RWSP water volumes in Table DCD 6.2.1-3.

d. ITAAC

Tier 1 and ITAAC provide top-level information that includes the principal performance characteristics and safety functions of SSC. MHI understands the importance of verifying as-built water retention locations, but considers this to be within the scope of existing ITAAC.

Inspection of containment after construction, to determine if all potential water retention locations have been identified and the amount of water has been conservatively estimated for each potential location, does not meet SRP 14.3 selection criteria. MHI considers a separate ITAAC for this purpose to represent an inappropriate level of detail and, therefore, to be unnecessary.

US-APWR DCD Revision 3 Tier 1 Table 2.4.4-5 ITAAC #1 verifies ECCS functional arrangement, and ITAAC #7.d verifies adequate safety injection pump available and required NPSH. The verification of NPSH available will include inspection of the as-built containment drawings to verify the holdup water volumes, in order to confirm the minimum RWSP water level. These existing ITAAC adequately verify the water retention locations at the proper level of detail.

e. Conversion of RWSP water volume to RWSP water level

The effective area of the RWSP will vary with the height from the bottom of the RWSP (EL 3'-7"), because there are elevator pit and concrete ducts inside the RWSP. Table e-1 shows the relationship between the height from the RWSP bottom and specific water level increase per gallon.

Table e-1: Height from RWSP bottom vs. water level rising ratio

Height from RWSP bottom	Effective area of RWSP	Water level increase per gallon
0 – 12' 2"	8.15×10^5 in^2	2.84×10^{-4} in/gal
12' 2" – 15' 11"	7.19×10^5 in^2	3.22×10^{-4} in/gal
15' 11' -	7.06×10^5 in^2	3.28×10^{-4} in/gal

There is no change to the previously calculated RWSP water volumes in Table DCD 6.2.1-3 (or, The revised RWSP areas above resulted in an increase of 3,000 gallons to the calculated RWSP liquid volume in DCD Table 6.2.1-5).

Summary

The total amount of holdup water volume will increase by about 24,180 gallons based on the refinements discussed above. On the other hand, MHI also re-calculated the as-designed holdup water volume (i.e., piping route change, building frame shape change, etc.). Incorporating both the increases from this RAI response and changes in the as-designed hold-up water volume, MHI confirmed that the design basis RWSP water level used for NPSH evaluation (i.e., EL 7'-7") does not change.

In section 3.7.2 of MUAP-08001 (Ref. 6), the calculation results and a margin above EL 7'-7" is described.~~In other words, calculated RWSP minimum water level was EL 8'-0" and design basis RWSP minimum water level is EL 7'-7" as described in Figure 3.9 of Technical Report MUAP-08001 R3 (Ref. 6). The water volume change resulted in the calculated water level (EL 8'-0") being lowered, but it was still over the design basis water level (EL 7'7") used for NPSH calculation.~~

However, the RWSP and holdup water volumes are described in DCD and the numerical value will change as shown in "Impact on DCD".

References

1) Bird, Stewart and Lightfoot, Transport Phenomena, Second Edition, p. 187
2) Subsection 6.2.2.3, DESIGN CONTROL DOCUMENT FOR THE US-APWR Chapter 6, Engineered Safety Features, MUAP- DC006 Revision 3, March 2011
3) Table 6.2.1-6, DESIGN CONTROL DOCUMENT FOR THE US-APWR Chapter 6, Engineered Safety Features, MUAP- DC006 Revision 3, March 2011
4) Nusselt, W., Die Oberflachenkondesation des Wasserdamffs the surface condensation of water. Zetrshr. Ver. Deutch. Ing., 60 (1916), 541-546
5) Bird, Stewart and Lightfoot, Transport Phenomena, Second Edition,.p.452
6) Mitsubishi Heavy Industries, LTD., US-APWR Sump Strainer Performance, MUAP-08001 Revision~~ 3, November 2010~~ 5, August 2011.
7) JIS B8302, Measurement methods of pump discharge, 2002 Edition, Japanese Standards Association.
8) Rao N.S. Govinda, Muralidhar D. "Discharge characteristics of weirs of finite crest width". J La Houille Blanche 1963;18(5):537–45.

Impact on DCD

DCD Tier 2 Table 6.2.1-3~~, and~~ Table 6.2.1-5 and Chapter 16 section 3.5.4 will be changed **as Attachment-1** due to changes in holdup water volume and the as-designed water volume as described in the Summary.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on S-COLA

There is no impact on the S-COLA.

Impact on PRA

There is no impact on the PRA.

Table 6.2.1-3 RWSP Design Features

Parameters	Value	
Nominal Liquid Surface Area	4985 ft^2	
Normal Liquid Volume (Water volume of 96 % water level excluding water below 0% level)	~~584,000 gallons~~76,600 ft^3 (573,000 gallons)	DCD_06.02.02-64
Return Water on the Way to RWSP (During a postulated accident)	~~137,000 gallons~~18,200 ft^3 (136,000 gallons)	DCD_06.02.02-64
Ineffective Pool	~~297,000 gallons~~41,300 ft^3 (309,000 gallons)	DCD_06.02.02-64
Minimum Liquid Volume	~~149,000 gallons~~17,100 ft^3 (128,000 gallons)	DCD_06.02.02-64

Table 6.2.1-5 Engineered Safety Feature Systems Information (Sheet 1 of 2)

US APWR Specification	Value	
	Full Capacity	Value Used for Containment Design Evaluation
I. Passive Safety Injection System		
A. Number of Accumulators	4	4
B. Pressure, psig	695	586
II. Active Safety Injection Systems		
A. High Head Injection System (HHIS)		
1. Number of Lines	4	2
2. Number of Pumps	4	2
3. Flow Rate, gpm/train *	1,540	1,259
4. Response Time, sec (after analytical limit of SI signal reached)	N/A	118
III. Containment Spray System (CSS)		
A. Number of Lines	4	2
B. Number of Pumps	4	2
C. Number of Headers	1	1
D. Flow Rate, gpm	9,800 (4 pumps)	5,290 (2 pumps)
E. Response Time, sec (after analytical limit of SI signal reached)	N/A	243
IV. Refueling Water Storage Pit (RWSP)		
A. Liquid volume. Gallons	~~651,000~~654,000	329,000
B. Liquid surface area ,ft^2	4,985	Interface Area is Ignored
V. Containment		
A. Free Volume (Air Volume), ft^3	2,800,000	2,743,000

DCD_06.02.02-64

Notes:
* HHIS flow rate is the value when RCS pressure is at 0psig.
Hot leg switch-over is conservatively not assumed, which leads to ignoring steam condensation with the hot leg injection.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	-----------------------------NOTE------------------------- Only required to be performed when containment air temperature is < 32°F or >120°F. --- Verify RWSP borated water temperature is ≥ 32°F and ≤ 120°F.	[24 hours OR In accordance with the Surveillance Frequency Control Program]
SR 3.5.4.2	Verify RWSP borated water volume is ≥ ~~583,340~~76,600 ft^3 (573,000 gallons).	[7 days OR In accordance with the Surveillance Frequency Control Program] DCD_06.02.02-64
SR 3.5.4.3	Verify RWSP boron concentration is ≥ 4000 ppm and ≤ 4200 ppm.	[7 days OR In accordance with the Surveillance Frequency Control Program]
SR 3.5.4.4	Verify isotopic concentration of B-10 in the RWSP is ≥ 19.9% (atom percent).	[24 hours OR In accordance with the Surveillance Frequency Control Program]