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Energy Systems

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DCP/NRC1246
NSD-NRC-98-5559
Docket No.: 52-003

February 5, 1998

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

ATTENTION: T. R. QUAY

SUBJECT: AP600 RESPONSE TO FSER OPEN ITEMS

Dear Mr. Quay:

Enclosed with this letter are the Westinghouse responses to FSER open items on the AP600. A summary of the enclosed responses is provided in Table 1. Included in the table is the FSER open item number, the associated OITS number, and the status to be designated in the Westinghouse status column of OITS.

The NRC should review the enclosures and inform Westinghouse of the status to be designated in the "NRC Status" column of OITS.

Please contact me on (412) 374-4334 if you have any questions concerning this transmittal.

Susan Fanto for
Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

jml

Enclosure

1/1

cc: W. C. Huffman, NRC (Enclosure)
T. J. Kenyon, NRC (Enclosure)
J. M. Sebrosky, NRC (Enclosure)
D. C. Scaletti, NRC (Enclosure)
N. J. Liparulo, Westinghouse (w/o Enclosure)

E004

Table 1
List of FSER Open Items Included in Letter DCP/NRC1246

FSER Open Item	OITS Number	Westinghouse status in OITS
480.1086F (R1)	6188	Action N
480.1120F	6544	Confirm W
480.1135F	6559	Confirm W
480.1158F	6582	Confirm W
480.1160F	6584	Action N

Enclosure to Westinghouse
Letter DCP/NRC1246

February 5, 1998

FSER OI 480.1086F Rev. 1 (OITS 6188)

The positioning of the MSLB-break location away from its original location at the top of the steam generator downward to the vicinity of the operating deck and into the center of the dome carries the following items of non-conservatism: (1) the removal of an asymmetric break, (2) a condition for more mixing above the operating deck, (3) the elimination of the stratification issue, (4) the artificial generation of a well-mixed condition in the dome region, and (5) the availability of two connections to the below-deck regions as compared to only one with the break in the top location.

The combination of these distortions stands a good chance of providing unrealistic computational results compared to the realistic break location. The MSLB is the limiting accident for the peak pressure in the AP600 therefore an analysis of the MSLB with the break location near the top of the steam generator is required.

Response:

The approach taken to bound effects of circulation and stratification for a main steam line break (MSLB) account for the momentum of the break flow that is released in the above deck region. The MSLB modeling approach considers the offsetting conditions of a) the elevation of a break in the main steam line above the operating deck; and b) the momentum available to mitigate the potential for stratification.

To put the stratification question into perspective, for post-blowdown (that is, low momentum) LOCA sources from elevated release points, data from facilities in the industry containment test database show that stratification can exist between regions above and below the source. An MSLB introduces momentum into the above-deck volume that ranges through the transient from 4 to 3 orders of magnitude greater than the momentum introduced by the post-blowdown LOCA at the top of the steam generator compartment (Reference 1, Section 6.5.2).

In the following discussion, LST results provide insight into the effects that break source elevation and momentum have on distribution of steam and thus containment mass transfer rates. Based on the MSLB test data, it can be concluded that the momentum introduced by an MSLB above the operating deck would homogenize the above-deck steam distribution in AP600. Such homogenization would occur, with releases anywhere between the operating deck and the top of the steam generator, directed horizontally or vertically.

Margins relative to these effects are included in the MSLB Evaluation Model. These margins include a) neglecting mass transfer enhancement due to forced convection; and b) elimination of floor surfaces for convective heat and mass transfer.

The following provides specific responses to the five points identified in the open item. The justification for the bounding MSLB Evaluation Model is summarized in Reference 2 Section 9.4.2. The discussions below consolidate information and provide supplemental LST data.

Summary Responses to Open Item Concerns

The use of the lumped parameter model in a manner which results in a homogeneous above-deck region and limits steam access below the operating deck is reasonable and bounds realistic containment atmosphere steam and noncondensible vertical distributions based on the supporting information provided below. The following responses are provided for each of the 5 concerns identified in the open item:

Response to Open Item Concern (1) "the removal of an asymmetric break"

Due to the momentum of the AP600 MSLB break source, the entire above-deck region would be nearly homogeneous in the AP600, regardless of an asymmetric break location, as determined by a Fr_v criterion developed for enclosures based on the LST.

Additionally, all above-deck surfaces would have a higher mass transfer than that predicted by the use of only free convection in the Evaluation Model. Wall surfaces toward which a break is directed would have a higher forced convection enhancement to mass transfer. Forced convection is neglected by assuming only free convection on internal heat sink surfaces and the internal surface of the PCS shell.

Response to Open Item Concern (2) "a condition for more mixing above the operating deck"

The above-deck region in AP600 would be nearly homogeneous during a MSLB due to the high source momentum. It is reasonable that the Evaluation Model predicts a homogeneous steam concentration above the operating deck.

Response to Open Item Concern (3) "the elimination of the stratification issue"

In fact, the Evaluation Model conservatively calculates stratification between the above- and below-deck regions, limiting steam access to the below-deck heat sinks which are important for MSLB pressure mitigation. In the lumped parameter model, below-deck, steam is only driven by vessel pressurization, not by global circulation, due to the simplifying assumption of momentum dissipation inherent within a lumped parameter volume.

A sensitivity calculation (Reference 2, Section 9.4.3) has been performed to quantify the effect of stratification above- and below-deck in the Evaluation Model. Using the lumped parameter MSLB model with the break boundary condition placed in the CMT North compartment, shows that better access of steam to below-deck heat sinks produces a reduction of 1.6 psi in peak pressure relative to the Evaluation Model.

Response to Open Item Concern (4) "the artificial generation of a well-mixed condition in the dome region"

The above-deck region in AP600 would be nearly homogeneous during a MSLB due to the high source momentum, so that it is reasonable for the Evaluation Model to predict a homogeneous steam concentration above the operating deck. The nearly homogeneous condition above the operating deck in the Evaluation Model is not an artificial condition.

Response to Open Item Concern (5) "the availability of two connections to the below-deck regions as compared to only one with the break in the top location"

The MSLB circulation differs from that in a LOCA DECLG. In the LOCA DECLG, releases from low in containment rise through the affected steam generator compartment into the above-deck region, and circulate down through openings such as the unaffected steam generator compartment. Such circulation has been called global, or large scale, circulation. In such a LOCA scenario with global circulation, one steam generator compartment has upflow while the other steam generator compartment has downflow.

For the MSLB Evaluation Model, the placement of the break node together with lumped parameter momentum formulation eliminates calculated global circulation. Therefore, all the openings, including those into both steam generator compartments, pass flow only due to pressurization of containment and condensation on below-deck heat sinks. Therefore, the placement of the break and its effect on the availability of paths for global circulation does not lead to nonconservatism in the Evaluation Model.

Supporting Information

The MSLB Evaluation Model is based on an understanding of AP600 behavior derived from test data. Test data includes (a) LST stratification data to assess the influence of momentum-induced circulation; and (b) LST data for condensation on the above-deck shell surface. The understanding of the potential for containment atmosphere stratification in the presence of high momentum releases is combined with known lumped parameter biases (Reference 2, Section 9.C.3.3) to establish a conservative model accounting for the potential effects of steam and noncondensible distributions.

Mass transfer is the dominant containment heat removal mechanism for a Design Basis Accident. The primary energy removal process is condensation on internal containment surfaces, which is affected by the distribution of steam and noncondensibles within the containment. Since the local noncondensible concentration is equal to the total vessel pressure minus the local steam concentration, the discussion that follows focuses on steam distributions.

AP600 MSLB Boundary Conditions

AP600 typical MSLB mass and energy release rate boundary conditions are provided in Reference 2 Section 4.5.2.2. Postulated break locations are discussed in Reference 2 Section 9.4.1. The open item concerns are related to the postulated release location of a MSLB in the pipe as it exits the top of the steam generator (see Reference 2 Figure 9-36).

Volumetric Froude Number in LST

The Froude number is a ratio of momentum-to-buoyancy effects. The definition of Froude number related to momentum effects with a finite height leads to the "volumetric Froude number," Fr_v, which considers the vessel height as a characteristic length and uses the difference in density between the incoming steam and the average, bulk mixture in the above-deck region (Reference 1, Section 6.5.1.2). The volumetric Froude number has been proposed by Peterson for use as a criterion for whether the momentum from a jet will homogenize a volume.

Peterson developed an infinite-pool stability criterion, above which the Froude number would indicate that the pool could be assumed to be homogeneous. Peterson's stability limit would be overly conservative for application to an enclosure. In the infinite pool, the buoyant source rises to the upper surface of the pool and travels outward; therefore its momentum and turbulence essentially leave the system. In an enclosure, the high momentum jet impinges on the opposite surface which redirects the flow parallel to the surface. The high momentum and turbulence are therefore retained in the system and can drive circulation below the break. Data from the LST are therefore used to establish a Fr_v criterion, which can be applied to enclosures, to indicate the conditions under which a volume can be assumed to be homogeneous.

The LST MSLB data are from tests with an elevated small diameter pipe: test 222.3 (jet 6 feet above the operating deck pointed horizontally) and test 222.4 (jet 6 feet above the operating deck pointed up). Those LST tests show the effect of the momentum of an elevated source of steam, both direction and magnitude.

Volumetric Froude numbers in the LST range down to $Fr_v = 0.29$, as shown on the Reference 2, Figure 9-1, with AP600 ranges shown on the attached Figure 480.1086F-1. The ordinate is the "measured local steam pressure ratio" at a particular elevation divided by the steam pressure ratio calculated assuming a homogeneous mixture. Data from two elevations are presented: the E elevation is at the operating deck level above the grating; and the F elevation is within six inches of the bottom of the vessel. The ordinate is a measure of the degree of homogeneity: the closer the value is to 1.0, the more uniform is the vertical gradient. Values less than 1.0 indicate that there is less steam (and thus more noncondensible) at that elevation than would exist if the mixture were uniform.

Considering the LST as an enclosure test, a criterion on which to base the assumption of momentum-induced homogeneity, when there is an elevated break source, can be determined. The data show that down to the lowest value tested, 0.29, the above deck region is essentially homogeneous. (Data showing vertical gradients of temperature and steam from elevation F up to the dome are discussed below.) Therefore, for values of $Fr_v \geq 0.29$ and an aspect ratio similar to AP600, the above-deck region can be considered to be homogeneous.

It is also evident in looking at MSLB ordinate values (and vertical gradient data discussed below) for the F elevation in Figure 480.1086F-1, that the test vessel is effectively uniform down to the F elevation, well below the operating deck. Therefore, for values of $Fr_v \geq 0.29$, the data suggest that a significant influence of circulation forced by jet momentum is felt below the operating deck in the LST enclosure. However, such forced circulation of steam below the operating deck is not included in the Evaluation Model, as discussed later.

LST Vertical and Horizontal Gradient Data

Vertical temperature and steam concentration gradients in the LST MSLB tests are shown in Reference 2, Figures 9-29 through 9-34. Data in Figure 9-31, at the lower end of the MSLB LST Froude number range, show that the steam concentration at elevation F, below the operating deck at the vessel bottom, is consistent with a momentum source forcing a negatively buoyant jet to penetrate below the deck, as shown qualitatively in Reference 2 Figure 9.C.1-11b. Thus, regardless of whether the jet is directed horizontally or vertically, data show that steam is driven by momentum to penetrate below the LST operating deck sufficiently to homogenize the entire test vessel, including the below-deck region.

Horizontal temperature gradients through the LST vessel at 5 elevations above the operating deck are shown in the attached Figures 480.1086F-2 through 480.1086F-5 for the tests 222.3 and 222.4. The two tests both have the source at an elevation 6 feet above the operating deck from a small diameter pipe to provide the higher source momentum. Shown for the steady state phase of each test are: the outside wall and inside wall temperatures; temperatures 1 inch away from the wall; and temperatures across the vessel from the thermocouple rake mounted within the vessel volume. The dimensions of wall thermocouples and the "one inch wall-mounted thermocouple" are shown in Figure 480.1086F-6.

As can be seen from the data figures, the vessel mixture temperature is nearly uniform horizontally between the thermocouples one inch from the walls at each elevation. Such uniformity is present regardless of whether the break is pointed up or toward the wall. Thus, the momentum introduced in the LST eliminates horizontal gradients outside the relatively thin laminar sublayer at the wall.

It has been shown for low momentum (LOCA configuration) conditions that the majority of the horizontal boundary layer concentration gradient occurs over much less than 1 inch at the operating deck level in the LST, without considering the suction effect. (See response to FSER Open Item 480.1085F. Those calculations for the LOCA configuration conservatively overestimate the thickness of the boundary layer for MSLB configuration since the higher momentum would lead to higher near-wall velocities which would tend to thin the boundary layer.) The MSLB data confirm that the concentration profiles for the MSLB are of the same order or less than the LOCA configuration, since the radial temperature plots show the gradient occurs over less than 1 inch from the wall surface.

Volumetric Froude Number in AP600

The Fr_v criterion for enclosures developed from the LST is used to assess the influence of momentum during the AP600 MSLB transient. The data show that for $Fr_v \geq 0.29$, vertical and horizontal gradients above the operating deck would be small due to large momentum-induced entrainment and circulation induced by the momentum impinging on the enclosure walls. The LST volumetric and jet Froude numbers as a function of time for the MSLB are shown in Reference 1, Figure 6-3. The AP600 Froude number is greater than 0.29 for the first 390 seconds of the transient, suggesting that the above-deck region in AP600 can be assumed to be homogeneous throughout that time.

From 390 to 570 seconds (the time of peak pressure), the value of Fr_v continues to gradually decrease to a value of 0.15, since the source momentum is gradually decreasing. In a quasi-steady condition when momentum is introduced into the vessel, the fluid contained in the volume circulates at a rate such that the parasitic losses, friction on the walls in this case, balance the momentum. This process of momentum-driven circulation results in a monotonic reduction in circulation with reduction in momentum; that is, there would not be an abrupt change in the degree of mixing over the range of Fr_v.

The time frame for changes in the degree of homogeneity in the above-deck region would be related to the volumetric time constant for replacing the air-steam mixture with the pure steam source. Assuming the region which would be affected is the upper half of the volume in the above deck region, 700,000 cubic feet, and a source flow at 500 seconds of 1225 cubic feet per second, the time constant is 571 seconds. The time constant is much greater than the 180 second duration beyond the test-based Fr_v criterion. In addition, entrainment into the downward flowing wall layer occurs throughout the transient, providing mixing over the height of the above-deck region. Therefore, the momentum introduced by the MSLB through the time frame of interest can be assumed to be sufficient to prevent a significant amount of stratification from developing. As a result, the AP600 MSLB above-deck region is sufficiently homogeneous to support the use of the lumped parameter model discussed below.

LST data also suggest that significant circulation into the volume below the operating deck (20% of containment free volume) may occur in AP600, such that enough momentum may be available to homogenize a significant fraction of the entire containment. Since methods are not available to quantify the amount of momentum-driven circulation below the operating deck in AP600 based on smaller scale tests, the Evaluation Model does not take credit for momentum-driven circulation below the operating deck, as discussed below.

The effects of momentum on condensation via forced convection are also discussed below. On the basis of *jet* Froude numbers in the LST (Reference 1, Figure 6-3), much of the jet height may be considered a forced jet and the momentum effects on convective transport cannot be neglected relative to buoyancy forces. Thus, it is expected that the condensation rates would show forced convection enhancements in the LST. Based on arguments presented above, the AP600 would similarly show forced convection enhancement throughout the MSLB transient.

LST Condensation Rate Data

The LST data has been used to derive condensation rates on the internal shell surface (Reference 3, Section 3.9). A comparison of the data from the MSLB configuration for LST tests 222.3 and 222.4 is given in Reference 3, Figure 3.9-5, represented as the ratio of the "predicted Sherwood number using free convection correlation" to "measured Sherwood number" as a function of elevation. The data show that the measured LST Sherwood number is significantly higher than predicted by free convection over nearly all of the vessel surface. The forced convection improvement ranges from a factor of 1 to 10 in the LST, with the higher value occurring at the elevation of the jet for the horizontal orientation, or at the underside of the dome for the vertical orientation. The MSLB condensation data are consistent with the expectation of significant forced convection contribution based on the volumetric Froude numbers.

Although LST data show that significant forced convection enhancement may occur due to the break source momentum, only free convection is credited in the MSLB Evaluation Model.

Bounding Lumped Parameter Evaluation Model

Biases are included in the MSLB related to circulation and stratification, including a conservative treatment of mass transfer correlations during the high velocity (momentum) MSLB releases. The following summarizes the related biases which have been incorporated into the Evaluation Model and then provides supporting information on lumped parameter modeling of the MSLB.

The Evaluation Model assumes only free convection on internal containment heat sinks, which conservatively neglects the enhancement to mass transfer from forced convection (high velocity) that would occur during an MSLB.

Test data discussed above provide evidence that the high momentum introduced during a MSLB above deck would homogenize the atmosphere above-deck, as well as drive some source steam below deck. Lumped parameter biases result in: a nearly homogeneous above-deck steam concentration; and limitation of steam access to heat sinks below deck as follows.

The MSLB Evaluation Model calculates a nearly homogeneous steam concentration in the above-deck volumes. As discussed in Reference 2, Section 9.4.2, the lumped parameter formulation inherently assumes that momentum is dissipated within a node. Since momentum is dissipated within the volume to which a boundary condition is attached, only buoyancy forces are modeled, and there is no driving force in the model for circulation below the assumed break node.

The lumped parameter MSLB evaluation model predicts a nearly homogeneous steam distribution above the deck as shown in Reference 1, Figure 9-60. Such a homogeneous condition is consistent with the volumetric Froude number criterion for homogeneity developed from tests; thus the above deck region can be assumed to be homogeneous for containment pressure calculations. From the figure, after an initial 10 second adjustment period, nearly homogeneous above-deck steam pressure ratios range over time from 0.5 to a 0.75.

Steam access to heat sinks below deck is limited by suppressing the effects of global circulation, as follows. The above-deck steam concentration of 0.5 to 0.75 can be compared to the concentration in below deck compartments, which generally ranges from 0.3 to 0.38, up to the time of peak pressure (Reference 1, Figure 9-60). The large difference in steam concentration between above- and below-deck regions results from the lack of global circulation within the model.

The transient steam concentration in the CMT South volume is noticeably delayed relative to the other below-deck compartments. Reference 1, Figure 9-60 shows that CMT South (volume 104) initially remains at a lower steam concentration than the other compartments at that below-deck level. The CMT South steam concentration then begins to rise through the rest of the transient until its concentration matches that of the other below-deck compartments at that level. The relative delay of steam access to the CMT South compartment is due to the more restrictive area of flow paths from above deck (flow path numbers 267 and 268) as compared to the flow areas feeding CMT North, Upper Steam Generator West, and Upper Steam Generator East volumes. Thus, calculated steam concentrations in compartments below deck are consistent with a lack of global circulation within the model.

Internal containment heat sinks are important for mitigation of MSLB containment pressure, due to the long time constant for heat removal through the PCS shell. Thus, artificially maintaining stratification in the lumped parameter model, between the above-deck region and below-deck region (where internal heat sinks are located), results in a conservatively high containment pressure.

Follow up Question from E. Throm (received via Email on 1/29/98):

Test 222.2 (RC065) would not support the Westinghouse position if it represents a possible situation in the AP600. The LST was ranged to the 102% power case, while the limiting case in the AP600 is 30% power. WCAP-14407 page 9-20, says see Fig 3.9-5 of WCAP-14326 to compare low velocity to high velocity case. The Figure compares two high velocity jets RC064 (to wall) and RC066 (upward). The low velocity case is RC065! It never shows up anywhere in terms of expect Froude number and relation to AP600.

Response to Follow up Question:

Clarification of Atypicality of LST 222.2

First, the database:

Elevated diffuser

222.2 A (RC065A)	**Frv = 0.011**
222.2 B (RC065B)	**Frv = 0.034**

Cases used in Open Item response

222.3A	**Frv = 0.29**	**(Basis for criterion used for mixed condition)**
222.3B	**Frv = 0.70**	
222.4A	**Frv = 0.39**	
222.4B	**Frv = 0.59**	

LST 222.2 is an elevated diffuser with a volumetric Froude number for steady state stage A (RC065A) Frv = 0.011, and stage B (RC065B) Frv = 0.034. Thus, the Froude number for this test is a factor of 4.4 lower than the minimum Frv achieved in the AP600 MSLB of Frv(AP600 min) = 0.15. Because the Frv of the LST 222.2 is below the AP600 range, it has been considered to be non-prototypic, and thus has not been included in data plots. LST 222.2 has been used to gain insight into momentum effects, and ties the LST database to the industry database with elevated, low momentum sources.

Clearly, somewhere between the Frv = 0.29 (222.3A) and Frv = 0.034 (222.2), the momentum becomes insufficient to develop a well mixed condition above-deck. In the response to 480.1086F, this has been addressed by assuming that, at Frv<0.29, the potential to develop stratification exists. The response then

examines the time frame necessary to develop significant stratification once the Frv drops below 0.23.

Note that the low velocity data contained in Figure 3.9-5 of WCAP-14326 is data from the LOCA configurations, a diffuser located below a simulated steam generator.

References

1. WCAP-14845, Rev. 2, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents," June, 1997.

2. WCAP-14407, Rev. 1, "WGOTHIC Application to AP600," July 1997.

3. WCAP-14326, Rev. 1, "Experimental Basis for the AP600 Containment Vessel Heat and Mass Transfer Correlations," May 1997.

SSAR Revisions: NONE

NOTE:

The figures referred to in the original response are Westinghouse Proprietary Class 2, and are not repeated in this revision. See the original response to 480.1086F transmitted via DCP/NRC1216, dated 1/16/98 for the figures.

Question: 480.1120F (OITS #6544)

The main control room isolation and air supply initiation of Table 3.3.2-1, function 20.a, based on control room air supply radiation - high 2, should be operable during core alterations, not just for movement of irradiated fuel assemblies (See Note h of function 20).

Response:

Agree. This Function will be required to be OPERABLE during CORE ALTERATIONS, to be consistent with Standard Technical Specifications, NUREG-1431, LCO 3.3.7, Control Room Emergency Filtration System Actuation Instrumentation requirements.

Since Note h is only used for Function 20, Main Control Room Isolation and Air Supply Initiation, the note will be revised to include CORE ALTERATIONS, consistent with STS 3.3.7, Control Room Emergency Filtration System Actuation Instrumentation, Applicability:

(h) During movement of irradiated fuel assemblies and during CORE ALTERATIONS.

This expansion in Applicability requires revision of Condition K (which only addresses movement of irradiated fuel assemblies), since it may no longer take the plant out of the specified Applicability. Condition K will be expanded to specify suspension of CORE ALTERATIONS. The LCO 3.3.2 Bases associated with Function 20 and Condition K will be revised to reflect these changes.

SSAR Revision: See attached mark-ups, pages 3.3-19, 3.3.-39, B 3.3-97, and B 3.3-109.

Table 3.3.2-1 (page 11 of 12)
Engineered Safeguards Actuation System Instrumentation

	FUNCTION	APPLICABLE MODES OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TRIP SETPOINT
20.	Main Control Room Isolation and Air Supply Initiation						
	a. Control Room Air Supply Radiation - High 2	1,2,3,4	2	F,O	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.5 SR 3.3.2.6		[≤ 2x10^{-6} curies/m^3 Dose Equivalent I-131]
		Note (h)	2	G,K	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.5 SR 3.3.2.6		[≤ 2x10^{-6} curies/m^3 Dose Equivalent I-131]
	b. Battery Charger Input Voltage - Low	1,2,3,4	4 divisions	B,O	SR 3.3.2.3 SR 3.3.2.4		[≥343 V*]
		Note (h)	4 divisions	G,K	SR 3.3.2.3 SR 3.3.2.4		[≥ 343 V*]
21.	Auxiliary Spray and Pu ification Line Isolation						
	a. Pressurizer Water Level - Low 1	,2	4	B,L	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.5 SR 3.3.2.6		[20.0%*]
22.	In-Containment Refueling Water Storage Tank (IRWST) Injection Line Valve Actuation						
	a. Manual Initiation	1,2,3,4$^{(j)}$	2 switch sets	E,N	SR 3.3.2.3		N/A
		4$^{(n)}$, 5, 6$^{(g)}$	2 switch sets	G,Y	SR 3.3.2.3		N/A
	b. ADS 4th Stage Actuation	Refer to Function 10 (ADS 4th Stage Actuation) for initiating functions and requirements.					
	c. Coincident RCS Loop 1 and 2 Hot Leg Level - w 2	4$^{(n)}$,5,6$^{(g)}$	1 per loop	H,Y	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.5 SR 3.3.2.6		[≥ 3 in. above bottom inside surface of the hot legs] bottom of the
23.	IRWST Containment Recirculation Valve Actuation						
	a. Manual Initiation	1,2,3,4$^{(j)}$	2 switch sets	E,N	SR 3.3.2.3		N/A
		4$^{(n)}$,5,6$^{(g)}$	2 switch sets	G,Y	SR 3.3.2.3		N/A
	b. Safeguards Actuation	Refer to Function 1 (Safeguards Actuation) for all initiating functions and requirements.					

Insert 23.c

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(continued)

(g) With upper internals in place and refueling cavity less than full.

(h) During movement of irradiated fuel assemblies. AND DURING CORE ALTERATIONS. RAI 480.1120F

(j) With the RCS not being cooled by the Normal Residual Heat Removal System (RNS).

(n) With the RCS being cooled by the

Table 3.3.2-1 (page 11 of 12)
Engineered Safeguards Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	NOMINAL TRIP SETPOINT
23. IRWST Containment Recirculation Valve Actuation					
a. Manual Initiation	1,2,3,4(j)	2 switch sets	E,N	SR 3.3.2.3	N/A
	4(n),5,6(g)	2 switch sets	G,Y	SR 3.3.2.3	N/A
b. Safeguards Actuation	Refer to Function 1 (Safeguards Actuation) for all initiating functions and requirements.				
Coincident with IRWST Level - Low 3	1,2,3,4(j)	4	B,N	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.5 SR 3.3.2.6	[≥ Containment Elevation @ 107' 2"]
	4(n),5,6(g)	4	I,Y	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.5 SR 3.3.2.6	[≥ Containment Elevation @ 107' 2"]

(continued)

Insert 23.b
(PAGE 3.3-39)

DCP/NRC 1119
11/5/97

480.1120F-3

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
J. One or two interlocks inoperable.	J.1	Verify the interlocks are in the required state for the existing plant conditions.	1 hour
	<u>OR</u>		
	J.2	Place any Functions associated with inoperable interlocks in bypass.	7 hours
			RAI 480.1120F
K. Required Action and associated Completion Time not met.	K.1	Suspend movement of irradiated fuel assemblies.	Immediately
	<u>AND</u>		
	K.2	SUSPEND CORE ALTERATIONS.	IMMEDIATELY
L. Required Action and associated Completion Time not met.	L.1	Be in MODE 3.	6 hours
M. Required Action and associated Completion Time not met.	M.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	M.2	Be in MODE 4.	12 hours
N. Required Action and associated Completion Time not met.	N.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	N.2	Be in MODE 4 with the RCS cooling provided by the RNS.	24 hours

(continued)

BASES

APPLICABLE SAFETY ANALYSES, LCOs, and APPLICABILITY

19.c. Containment Radioactivity - High 1 (continued)

being released to the atmosphere. These Functions are not required to be OPERABLE in MODES 4, 5, and 6 because any DBA release of radioactivity into the containment in these MODES would not require containment isolation.

19.b. Containment Isolation

Containment Air Filtration System Isolation is also initiated by all Functions that initiate Containment Isolation. The Containment Air Filtration System Isolation requirements for these Functions are the same as the requirements for the Containment Isolation. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 3, Containment Isolation, is referenced for initiating Functions and requirements.

20. Main Control Room Isolation and Air Supply Initiation

Isolation of the main control room and initiation of the air supply provides a protected environment from which operators can control the plant following an uncontrolled release of radioactivity. This Function is required to be OPERABLE in MODES 1, 2, 3, and 4, and during movement of irradiated fuel because of the potential for a fission product release following a fuel handling accident, or other DBA.

INSERT

RAI 480.1120F

20.a. Control Room Air Supply Radiation - High 2

Two radiation monitors are provided on the main control room air intake. If either monitor exceeds the High 2 setpoint, control room isolation is actuated.

20.b. Battery Charger Input Voltage - Low

Low input voltage to the 1E dc battery chargers will actuate main control room isolation and air supply initiation. This was previously described as Function 15.c.

(continued)

RAI 480.1120F

INSERT BASES PAGE B 3.3-97
FUNCTION 20, MAIN CONTROL ROOM ISOLATION AND AIR SUPPLY INITIATION

This Function is required to be OPERABLE during CORE ALTERATIONS, to be consistent with Standard Technical Specifications, NUREG-1431, LCO 3.3.7, Control Room Emergency Filtration System Actuation Instrumentation requirements.

BASES

ACTIONS

J.1 and J.2 (continued)

with two channels in bypass one-out-of-two logic, a single failure in one of the two remaining channels could cause a spurious interlock state change.

K.1 and K.2

CORE ALTERATIONS AND

RAI #480.1120F

Condition K is applicable to the MCR isolation and air supply initiation function, during movement of irradiated fuel assemblies. If the Required Action and associated Completion Time of the first Condition listed in Table 3.3.2-1 is not met, the plant must suspend movement of the irradiated fuel assemblies immediately. The required action suspends activities with potential for releasing radioactivity that might enter the MCR. This action does not preclude the movement of fuel to a safe position.

L.1

If the required Action and associated Completion Time of the first Condition listed in Table 3.3.2-1 is not met, the plant must be placed in a MODE in which the LCO does not apply. This accomplished by placing the plant in MODE 3 within 6 hours. The allowed time is reasonable, based operating experience, to reach the required plant conditions from full power conditions in an orderly manner without challenging plant systems.

M.1 and M.2

If the Required Action and associated Completion Time of the first condition listed in Table 3.3.2-1 is not met, the plant must be placed in a MODE in which the LCO does not apply. This is accomplished by placing the plant in MODE 3 within 6 hours and in MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner without challenging plant systems.

(continued)

480.1120F-7

Question: 480.1135F (OITS #6559)

Containment Isolation Valve TS surveillance requirement SR 3.6.3.4 verifies the isolation time of each automatic containment isolation valve. The TS BASES for SR 3.6.3.4 states that the isolation times are provided in SSAR 6.2.3. SSAR 6.2.3 references SSAR Table 6.2.3-1 which has specific isolation times for a few of the containment isolation valves. However, the majority of the valves are listed as having a closure time which is "Industry standard for the valve type." The statement on industry standards does not provide any upper limit for the closure times SSAR section 6.2.3 should clearly state that all containment isolation valves which have automatic closure have a closure time which conforms with ANS-56.2-1976 and are less than 60 seconds as specified in the NRC standard review plan. This is consistent with the wording in SSAR Section 6.2.3.4.1.

Response:

SSAR subsection 6.2.3.4.1 describes the preoperational testing for the containment isolation system. This includes a verification of the containment purge isolation valves to close within 5 seconds and all other containment isolation valves to close within 60 seconds. In addition, SSAR Table 6.2.3-1 will be revised to note the upper limit (60 sec.) for isolaton times for the containment isolation valves.

SSAR Revision: See attached markup

Table 6.2.3-1

Containment Mechanical Pen

Explanation of Heading and Acronyms for Table 6.2.3-1

System:	Fluid system penetrating containment
Containment Penetration:	These fields refer to the penetration itself
Line:	Fluid system line
Flow:	Direction of flow in or out of containment
Closed Sys IRC:	Closed system inside containment as defined in SSAR Section 6.2.3.1.1
Isolation Device:	These fields refer to the isolation devices for a given penetration
Valve/Hatch ID:	Identification number on P&ID or system figure
Subsection Containing Figure:	Safety analysis report containing the system P&ID or figure
Position N-S-A:	Device position for N (normal operation) S (shutdown) A (post-accident)
Signal:	Device closure signal

MS:	Main steamline isolation
LSL:	Low steamline pressure
MF:	Main feedwater isolation
LTC:	Low T_{cold}
PRHR:	Passive residual heat removal actuation
T:	Containment isolation
S:	Safety injection signal
HR:	High containment radiation
DAS:	Diverse actuation system signal
PL2:	High 2 pressurizer level signal
S+PL1:	Safety injection signal plus high 1 pressurizer level
SGL:	High steam generator level

Notes:

1. Containment leak rate tests are designated Type A, B, or C according to 10CFR50, Appendix J.
2. The secondary side of the steam generator, including main steam, feedwater, startup feedwater, blowdown and sampling piping from t reactor coolant pressure boundary and do not open directly to the containment atmosphere during post-accident conditions. During Ty differential pressure is applied to this boundary.
3. The central chilled water system remains water-filled and operational during the Type A test in order to maintain stable containment at
4. The containment isolation valves for this penetration are open during the Type A test to facilitate testing. Their leak rates are measure
5. The inboard valve flange is tested in the reverse direction.
6. These valves are not subject to a Type C test. Upstream side of RNS hot leg suction isolation valves is not vented during local leak rat
7. The inboard globe valve is tested in the reverse direction. The test is conservative since the test pressure tends to unseat the valve disc,
8. Refer to SSAR Table 15.0-4b for PORV block valve closure time.

heet 4 of 4)

rations and Isolation Valves

Closure Time:
Required valve closure stroke time
std: Industry standard for valve type (≤ 60 seconds)
N/A: Not Applicable

Test: These fields refer to the penetration testing requirements

Type: Required test type

A: Integrated Leak Rate Test
B: Local Leak Rate Test -- penetration
C: Local Leak Rate Test -- fluid systems

Note: See notes below
Medium: Test fluid on valve seat
Direction: Pressurization direction

Forward: High pressure on containment side
Reverse: High pressure on outboard side

steam generators to the containment penetration, is considered an extension of the containment. These systems are not part of the
A tests, the secondary side of the steam generators is vented to the atmosphere outside containment to ensure that full test

ospheric conditions.

eparately.

est to retain double isolation of RCS at elevated pressure. Valve is flooded during post accident operation.

hereas containment pressure would tend to seat the disc.

9802120320-01

480.1135F-2

Question: 480.1158F (OITS #6582)

TS 3.7.6 should be revised to be applicable during any core alterations consistent with the way core alterations are defined in TS 3.9.4 and in standard technical specification. In addition, other areas of the technical specification should be reviewed to refer to core alterations instead of fuel movement (e.g., TS 3.3.2).

Response:

Agree. The VES will be required to be OPERABLE during CORE ALTERATIONS, to be consistent with Standard Technical Specifications, NUREG-1431, LCO 3.7.10, Control Room Emergency Filtration System requirements.

The AP600 LCO 3.7.6, Main Control Room Habitability System (VES), will be revised to expand the Applicability to include CORE ALTERATIONS. This change is consistent with the same Applicability change to ESFAS (LCO 3.3.2) Function 20, Room Main Control Room Isolation and Air Supply Initiation discussed in the response to RAI 480.1120F.

This expansion in Applicability requires revision of the Condition statements of E and G to include "CORE ALTERATIONS." The Required Actions of E and G are adequate, since both currently specify suspension of CORE ALTERATIONS.

The LCO 3.7.6 Bases associated with the Applicability and with and Conditions E and G will be revised to reflect these changes.

SSAR Revision: See attached mark-ups, pages 3.7-12, 3.7-13, 38, B 3.3-96. Note that additional changes to this TS have been made in response to FSER Open Item 410.414F. These changes are not reflected in the attached mark-ups.

3.7 PLANT SYSTEMS

3.7.6 Main Control Room Habitability System (VES)

LCO 3.7.6 Two Main Control Room (MCR) Habitability System trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4,
During movement of irradiated fuel assemblies,
DURING CORE ALTERATIONS.

RAI 480.1158F

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One VES train inoperable.	A.1 Restore VES train to OPERABLE status.	7 days
B. MCR air temperature not within limit.	B.1 Restore MCR air temperature to within limit.	24 hours
C. Loss of integrity of MCR pressure boundary.	C.1 Restore MCR pressure boundary to OPERABLE status	24 hours
D. Required Action and associated Completion Time of Conditions A, B, or C not met in MODE 1, 2, 3, or 4.	D.1 Be in MODE 3.	6 hours
	AND	
	D.2 Be in MODE 5.	36 hours
E. Required Action and associated Completion Time of Conditions A, B, or C not met during movement of irradiated fuel, OR DURING CORE ALTERATIONS.	E.1 Suspend CORE ALTERATIONS.	Immediately
	AND	
	E.2 Suspend movement of irradiated fuel assemblies.	Immediately

(continued)

480.1155F-2

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Two VES trains inoperable in MODE 1, 2, 3, or 4.	F.1 Be in MODE 3.	6 hours
	AND	
	F.2 Be in MODE 4.	12 hours
	AND	
	F.3 Restore one VES train to OPERABLE status.	36 hours
G. Two VES trains inoperable during movement of irradiated fuel, or during CORE ALTERATIONS.	G.1 Suspend CORE ALTERATIONS.	Immediately
	AND	
	G.2 Suspend movement of irradiated fuel assemblies.	Immediately
RAI 480.1158F		

B 3.7 PLANT SYSTEMS

B 3.7.6 Main Control Room Emergency Habitability System

BASES

BACKGROUND

The Main Control Room Habitability System (VES) provides a protected environment from which operators can control the plant following an uncontrolled release of radioactivity. The system is designed to operate following a Design Basis Accident (DBA) which requires protection from the release of radioactivity. In these events, the Nuclear Island Non-Radioactive Ventilation System (VBS) would continue to function if AC power is available. If AC power is lost or a High-2 main control room (MCR) radiation signal is received, the VES is actuated. The major functions of the VES are: 1) to provide forced ventilation to deliver an adequate supply of breathable air for the MCR occupants; 2) to provide forced ventilation to maintain the MCR at a 1/8 inch water gauge positive pressure with respect to the surrounding areas; and 3) to limit the temperature increase of the MCR equipment and facilities that must remain functional during an accident, via the heat absorption of passive heat sinks.

The VES consists of two redundant trains each with compressed air storage tanks and associated valves, piping, and instrumentation. Each set of tanks contains enough breathable air to supply the required air flow to the MCR for at least 72 hours. The VES system is designed to maintain CO_2 concentration less than 0.5% for up to 11 MCR occupants with both trains operating. With one train operating, VES maintains CO_2 concentration less than 0.5% for up to 5 MCR occupants, and maintains CO_2 concentration less than 1.0% for up to 11 MCR occupants.

Sufficient thermal mass exists in the surrounding concrete structure (including walls, ceiling and floors) to absorb the heat generated inside the MCR, which is initially at or below 78°F. Heat sources inside the MCR include operator workstations, emergency lighting and occupants. Sufficient insulation is provided surrounding the MCR pressure boundary to preserve the minimum required thermal capacity of the heat sink. The insulation also limits the heat gain from the adjoining areas following the loss of VBS cooling.

(continued)

480.1158F-4

BASES

BACKGROUND (continued)

If the VBS remains unavailable following the 72 hour period, cooling of the MCR air is achieved by portable air coolers.

The compressed air storage tanks are initially pressurized to 3400 psig. During operation of the VES, a self contained pressure regulating valve maintains a constant downstream pressure regardless of the upstream pressure. An orifice downstream of the regulating valve is used to control the air flow rate into the MCR. The MCR is maintained at a 1/8 inch water gauge positive pressure to minimize the infiltration of airborne contaminants from the surrounding areas.

APPLICABLE SAFETY ANALYSES

Two redundant sets of compressed air storage tanks are sized such that each set of tanks has a combined capacity that provides at least 72 hours of VES operation.

Operation of the VES is automatically initiated by either of two safety related signals: 1) undervoltage to Class 1E battery charger, or 2) high-2 particulate or iodine radioactivity.

In the event of a loss of all AC power, the VES functions to provide ventilation, pressurization, and cooling of the MCR pressure boundary.

In the event of a high level of gaseous radioactivity outside of the MCR, the VBS continues to operate to provide pressurization and filtration functions. The MCR air supply downstream of the filtration units is monitored by a safety related radiation detector. Upon exceeding a predetermined undervoltage to Class 1E battery charger or high-2 particulate or iodine radioactivity setpoint, a safety related signal is generated to isolate the MCR from the VBS and to initiate air flow from the VES storage tanks. Isolation of the VBS consists of closing safety related dampers in the supply and exhaust ducts that penetrate the MCR pressure boundary. VES air flow is initiated by a safety related signal which opens the isolation valves in the VES supply lines.

The VES functions to mitigate a DBA or transient that either assumes the failure of or challenges the integrity of the fission product barrier.

(continued)

480.1158F-5

BASES

APPLICABLE SAFETY ANALYSES (continued)	The VES satisfies the requirements of Criterion 3 of the NRC Policy Statement.
LCO	The VES limits the MCR temperature rise and maintains the MCR at a positive pressure relative to the surrounding environment. Two independent and redundant VES trains are required to be OPERABLE to ensure that at least one is available, assuming a single failure disables the other train. The VES is considered OPERABLE when the individual components necessary to deliver a supply of breathable air to the MCR are OPERABLE in both trains. This includes components listed in SR 3.7.6.2 through 3.7.6.8. In addition, the MCR pressure boundary must be maintained, including the integrity of the walls, floors, ceilings, duct work, electrical and mechanical penetrations, and access doors.
APPLICABILITY RAI 480.1158F INSERT →	The VES is required to be OPERABLE in MODES 1, 2, 3, and 4 and during movement of irradiated fuel because of the potential for a fission product release following a DBA. The VES is not required to be OPERABLE in MODES 5 and 6 when irradiated fuel is not being moved because accidents resulting in fission product release are not postulated.
ACTIONS	<u>A.1</u> When one VES train is inoperable, action is required to restore the system to OPERABLE status. A Completion Time of 7 days is permitted to restore the train to OPERABLE status before action must be taken to reduce power. The Completion Time of 7 days is based on engineering judgment, considering the low probability of an accident that would result in a significant radiation release from the fuel, the low probability of not containing the radiation, and that the remaining train can provide the required capability.

(continued)

480.1158F-6

INSERT BASES PAGE B 3.7-28
APPLICABILITY

The VES is required to be OPERABLE during CORE ALTERATIONS, to be consistent with Standard Technical Specifications, NUREG-1431, LCO 3.7.10, Control Room Emergency Filtration System requirements.

BASES

ACTIONS (continued)

B.1

When the main control room air temperature is outside the acceptable range during VBS operation, action is required to restore it to an acceptable range. A Completion Time of 24 hours is permitted based upon the availability of temperature indication in the MCR. It is judged to be a sufficient amount of time allotted to correct the deficiency in the nonsafety ventilation system before shutting down.

C.1

If the MCR pressure boundary is damaged or otherwise degraded, action is required to restore the integrity of the pressure boundary and restore it to OPERABLE status within 24 hours. A Completion Time of 24 hours is permitted based upon operating experience. It is judged to be a sufficient amount of time allotted to correct the deficiency in the pressure boundary.

D.1 and D.2

In MODES 1, 2, 3, or 4 if Conditions A, B, or C cannot be restored to OPERABLE status within the required Completion Time, the plant must be placed in a MODE that minimizes accident risk. This is done by entering MODE 3 within 6 hours and MODE 5 within 36 hours.

E.1 and E.2

OR CORE ALTERATIONS

RAI 480.1158F

During movement of irradiated fuel assemblies, if the inoperable VES train cannot be restored to OPERABLE status, Required Actions A.1, B.1, or C.1 cannot be completed within the required Completion Time, the movement of fuel and core alterations must be suspended. Performance of Required Action E.1 and E.2 shall not preclude completion of actions to establish a safe condition.

F.1, F.2, and F.3

If both VES trains are inoperable in MODES 1, 2, 3, or 4, the VES may not be capable of performing the intended function, and must be brought to MODE 4, where the probability and consequences of an event are minimized, and one VES train must be restored to OPERABLE status within 36 hours. This is done by entering MODE 3 within 6 hours and MODE 4 within 24 hours.

(continued)

BASES

RAI 480.1158

ACTIONS (continued)

G.1 and G.2

OR CORE ALTERATIONS

During movement of irradiated fuel assemblies with two VES trains inoperable, the Required Action is to immediately suspend activities that present a potential for releasing radioactivity that might enter the MCR. This places the plant in a condition that minimizes risk. This does not preclude the movement of fuel to a safe position.

SURVEILLANCE REQUIREMENTS

SR 3.7.6.1

The MCR air temperature is checked at a frequency of 24 hours to verify that the VBS is performing as required to maintain the initial condition temperature assumed in the safety analysis, and to ensure that the MCR temperature will not exceed the required conditions after loss of VBS cooling. The surveillance limit of 78°F is the nominal temperature. The safety analysis value of 80°F includes a 2°F measurement uncertainty. The 24 hour Frequency is acceptable based on the availability of temperature indication in the MCR.

SR 3.7.6.2

Verification every 24 hours that compressed air storage tanks are pressurized to [≥ 3400 psig] is sufficient to ensure that there will be an adequate supply of breathable air to maintain MCR habitability for a period of 72 hours. The Frequency of 24 hours is based on the availability of pressure indication in the MCR.

SR 3.7.6.3

VES air delivery isolation valves are required to be verified as OPERABLE. The Frequency required is in accordance with the Inservice Testing Program.

SR 3.7.6.4

VES air header isolation valves are required to be verified open at 31 day intervals. This SR is designed to ensure that the pathways for supplying breathable air to the MCR are available should loss of VBS occur. These valves should be closed only during required testing or maintenance of downstream components, or to preclude complete depressurization of the system should the VES isolation valves in the air delivery line open inadvertently or begin to leak.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.6.5

Verification that all VBS isolation devices are operable and will actuate upon demand is required every 24 months to ensure that the MCR can be isolated upon loss of VBS operation.

SR 3.7.6.6

Verification that each VES pressure relief isolation valve within the MCR pressure boundary is OPERABLE is required in accordance with the Inservice Testing Program. The SR is used in combination with SR 3.7.6.7 to ensure that adequate vent area is available to mitigate MCR overpressurization.

SR 3.7.6.7

Verification that the VES pressure relief damper is OPERABLE is required at 24 month intervals. The SR is used in combination with SR 3.7.6.6 to ensure that adequate vent area is available to mitigate MCR overpressurization.

SR 3.7.6.8

Verification of the operability of the self-contained pressure regulating valve in each VES train is required in accordance with the Inservice Testing Program. This is done to ensure that a sufficient supply of air is provided as required, and that uncontrolled air flow into the MCR will not occur.

SR 3.7.6.9

This SR requires the performance of a system performance test of the VES to verify MCR pressurization capabilities. The system performance test demonstrates that the MCR pressurization assumed in dose analysis is maintained. Although the likelihood that system performance would degrade when time is low, it is considered prudent to periodically verify system performance. The System Level Operability Testing Program provides specific test requirements and acceptance criteria.

(continued)

BASES (continued)

REFERENCES

1. AP600 SSAR, Section 6.4, "Main Control Room Habitability Systems."

2. AP600 SSAR, Section 9.4.1, "Nuclear Island Non-Radioactive Ventilation System."

3. SECY-95-132, "Policy and Technical Issues Associated With The Regulatory Treatment of Non-Safety Systems (RTNSS) In Passive Plant Designs (SECY-94-084)," May 22, 1995.

Question: 480.1160F (OITS #6584)

A safe end-state condition for a number of technical specification is Mode 5 with the RCS intact and visible level in the pressurizer. Discussions in various AP600 technical specification BASES implies that RCS intact means that the RCS pressure boundary is closed. Discuss the use of nozzle dams and the implications of requiring the removal of nozzle dams to re-establish a closed RCS pressure boundary and the time requirements to remove the nozzle dams. Discuss the RCS pressure resulting from a loss of RHR event requiring the RCS to be closed up. WCAP-14837 indicates that the nozzle dam design pressure is 40 psia and that the maximum pressure following a loss of shutdown cooling in Mode 5 with the RCS pressure boundary open is less than 32 psia. What actions would be taken to achieve an intact RCS in accordance with tech spec 3.6.7, if the passive containment cooling system becomes inoperable with the nozzle dams installed?

Response:

Removal of nozzle dams is required to achieve RCS Intact status. Nozzle dam installation and/or removal time is approximately 12 hours. In Mode 5, the nozzle dams would be removed, and the RCS pressure boundary would be re-established. In Mode 6, the plant would continue to refueling cavity full, upper internals removed.

If the guidance provided in Technical Specification 3.6.7 is in conflict with that provided in 3.6.8 due to multiple failures of the safety systems, then Technical Specification 3.0.8 would be entered, as discussed in the response to RAI 480.1128F.

SSAR Revision:

None