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

ATTENTION: T. R. QUAY

SUBJECT: WESTINGHOUSE RESPONSES TO NRC REQUESTS FOR ADDITIONAL INFORMATION ON THE AP600

Dear Mr. Quay:

Enclosed are three copies of the Westinghouse responses to NRC requests for additional information on AP600 topics. Responses to 280.12, 280.21, 280.22, 280.23, 280.24, 280.25 and 280.26 provide additional information on Section 9.5.1 of the SSAR. Responses to 480.277, 480.287, 480.329, 480.330, 480.378, 480.379, 480.380 and 480.396 respond to questions on the WGOTHIC computer code.

These responses close the subject RAIs.

The NRC technical staff should review these responses as a part of their review of the AP600 design.

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

Brian A McIntyre, Manager
Advanced Plant Safety and Licensing

/nja

Attachment
Enclosures

cc: T. Kenyon, NRC (w/o enclosures)
D. Jackson, NRC (1E1)
E. Throm, NRC (w/o enclosures)
J. Kudrick, NRC (w/o enclosures)

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Question 280.12

Re: STAFF FOLLOW ON QUESTIONS AND REVIEW STATUS, SSAR SECTION 9.5.1 - FIRE PROTECTION (June 24, 1996 letter).

9.5.1.6 Safe Shutdown Capability.

For AP600, Westinghouse defined the safe shutdown condition as that reactor condition when the reactor is subcritical (i.e., Keff < 0.99) and the reactor coolant temperature is greater than 200 F but does not exceed 420 F. In SSAR Section 7.4, "Systems Required for Safe Shutdown," Westinghouse discusses how safe shutdown can be achieved using only safety-related equipment following a transient or accident condition. In SSAR Section 9.A.2.7.2, "Safe shutdown Methodology," Westinghouse identifies the methods used for safe shutdown as it relates to a fire event in the plant. The above section indicates that the safe shutdown process, the systems used and functional requirements for safe shutdown described in Section 7.4 are equally applicable to fire scenarios. SSAR Sections 7.4 and 9.A.2.7.2 imply that following a fire event in the plant, safe shutdown can be achieved within 36 hours using only safety-related equipment. Also, SSAR Section 7.4 describes how nonsafety-related equipment can be used to achieve and maintain safe shutdown, when they are available. SSAR Sections 7.4 and 9.A.2.7.2 credit only safety-related equipment for achieving safe shutdown; however, SSAR Section 7.4.1.2 expects that safety-related equipment will be used only when nonsafety-related equipment is unavailable. SSAR Section 7.4 points out that safe shutdown can be maintained for at least 36 hours using only safety-related equipment after it has been achieved. Based on its review of Section 7.4, the staff has determined that safe shutdown as defined above can be achieved within 36 hours following a fire event using only safety-related equipment and can be maintained long-term (i.e., beyond 36 hours after it has been achieved) provided: (1) the safety-related passive systems used for safe shutdown perform their intended design function; (2) nonsafety-related equipment are available for long-term maintenance of safe shutdown; and (3) all staff's concerns identified in the following sections are resolved. For the above reasons, consistent with SECY-94-084 (approved by Commission, see SRMs dated June 30, 1994 and June 28, 1995) position on safe shutdown requirements for passive plant designs, the staff accepts safe shutdown as defined above as a safe stable shutdown condition for AP600, subject to an acceptable passive system performance and an acceptable resolution of the issue of regulatory treatment of non-safety systems (RTNSS). By letter dated September 24, 1993, Westinghouse submitted WCAP-13856, a summary report on the AP600 implementation of the RTNSS process. The staff is currently reviewing the above report as well as General Electric Advanced Boiling Water Reactor (ABWR) SSAR information as it relates to the performance characteristics of safety-related passive systems. Therefore, safe shutdown condition as defined above in relation to a fire event is RAI # 280.12 and is designated as Open Item 9.5.1.6-1.

Response:

Westinghouse concurs with the definition of safe shutdown presented in this Request for Additional Information.

SSAR Revision: None

Question 280.21

Re: STAFF FOLLOW ON QUESTIONS AND REVIEW STATUS, SSAR SECTION 9.5.1 - FIRE PROTECTION (June 24, 1996 letter).

9.5.1.6.5 Additional Features to Ensure Safe Shutdown Capability.

Regarding ADS valves, Westinghouse states on SSAR Page 9A-88 that fire-induced ADS valve actuations cannot damage a low-pressure system; however, the SSAR does not explain the above position. Further contrary to what the subject SSAR page states (i.e., the ADS valves do not represent a high/low pressure interface, since the system is entirely within containment and this is as per GL 81-12), GL 81-12 does not limit considerations of fire-induced breaches of high/low pressure interfaces and their consequences to only fire areas outside the containment. For the above reasons, fire-induced ADS valve actuations and their consequences on low-pressure system is RAI # 280.21 and is designated as Open Item 9.5.1.6-10.

Response:

The intended function of the ADS valves during selected design basis accidents is to open. As a result, the systems, structures and components downstream of the ADS valves are designed to accommodate the effects of them opening.

In addition, inadvertent opening of ADS valves is addressed as a possible design basis accident in the safety evaluations discussed in SSAR Chapter 15. Fire-induced ADS valve actuations are considered to be one of a number of possible mechanisms for inadvertent actuation. The consequences are considered to be the same as for other possible mechanisms for inadvertent ADS valve actuation. By design, inadvertent actuations of the ADS valves cannot damage a low-pressure system.

SSAR Revision: None

Question 280.22

Re: STAFF FOLLOW ON QUESTIONS AND REVIEW STATUS, SSAR SECTION 9.5.1 - FIRE PROTECTION (June 24, 1996 letter).

9.5.1.6.5 Additional Features to Ensure Safe Shutdown Capability. The staff finds that SSAR Section 9A does not explain how other high/low pressure interface valves in the chemical and volume control system (CVS) makeup system, CVS-letdown line and process sampling system are protected against fire-induced breaches and their consequences on safe shutdown capability. The above concern is RAI # 280.22 and is designated as Open Item 9.5.1.6-11.

Response:

SSAR Appendix 9A, Revision 8, addresses chemical and volume control system (CVS) makeup and letdown valves and the primary sampling system (PSS) valves important to safe shutdown in Table 9A-2. These valves are in Fire Area 1000 AF 01, Fire Zones 1100 AF 11208, 1100 AF 11300A, and 1100 AF 11300B; Fire Area 1200 AF 01, Fire Zone 1200 AF 12269; and Fire Areas 1204 AF 01 and 1220 AF 02. Evaluation of these fire zones is included in SSAR subsections 9A.3.1.1.5, 9A.3.1.1.7, 9A.3.1.1.8, 9A.3.1.3.1.1, 9A.3.1.3.1.3, and 9A.3.1.3.1.4. The valves are listed as safety related for their containment isolation function. The CVS makeup and letdown line valves and the PSS valves are not required for safe shutdown. As indicated in the text of Appendix 9A, the valves in the area assumed to have the fire are assumed to fail with containment isolation being satisfied by the corresponding valve in another fire area. Fire induced breaches will have no effect on safe shutdown capability because pipe breaks assumed for loss of coolant accidents are larger than the CVS and PSS valves and their associated lines.

SSAR Revision: NONE

Question 280.23

Re: STAFF FOLLOW ON QUESTIONS AND REVIEW STATUS, SSAR SECTION 9.5.1 - FIRE PROTECTION (June 24, 1996 letter)

9.5.1.6.5 Additional Features to Ensure Safe Shutdown Capability. Regarding fire-induced associated circuit concerns, Westinghouse states in SSAR Section 9.5.1.2.1.1 (Page 9.5-5) that outside the containment/shield building fire area, MCR and the RSS, three hour fire barriers provide complete separation of redundant safe shutdown components including equipment, electrical cables and instrumentation and controls. Based on the SSAR information given above, the staff has determined that a fire in any fire area outside the containment, MCR and RSS will not result in associated circuit concerns that can compromise safe shutdown capability from the MCR. In the MCR and RSS, the divisional safe shutdown cables are not separated by 3-hour fire barriers. However, since control from the RSS is not normally activated, no fire-induced spurious signals are expected in the event of a fire in the RSS. Therefore, the staff finds that a fire in the RSS will not result in associated circuit concerns that can compromise safe shutdown capability from the MCR. Regarding a disabling fire in the MCR, as given in Section 9.5.1.6.4 of this report, once MCR is electrically isolated from the RSS by transferring control of safe shutdown capability from the MCR to the RSS, subsequent electrical faults (i.e., fire-induced associated circuits interactions) in the MCR will have no effect on the ability to achieve safe shutdown from the RSS. However, as stated in the section, fire-induced electrical faults prior to MCR isolation can compromise safe shutdown capability from the RSS. Therefore, subject to resolution of Open Item 9.5.1.6-9 identified in Section 9.5.1.6.4, fire-induced associated circuits problems need not be a concern for a fire in the MCR. Regarding a fire in any fire zone inside the containment/shield building fire area, as discussed in Section 9.5.1.6.3 of this report, Westinghouse has not satisfactorily addressed how fire-induced associated circuit problems, which may compromise safe shutdown capability, is eliminated. This concern is RAI # 280.23 and is designated as Open Item 9.5.1.6-12.

Response:

SSAR Appendix 9A provides a fire protection analysis and an associated fire related safe shutdown analysis. Subsection 9A.3.1.1 and its subsections provide descriptions of the results of these analyses organized by the fire zones within containment/shield building. The results of these analyses indicate that sufficient separation of redundant safe shutdown components exist based upon component placement within separate fire zones. Note, that there are no associated circuits in containment. The analysis indicates that there are no fire induced circuit problems inside the containment/shield building which may compromise safe shutdown capability.

SSAR Revision: None

Question 280.24

Re: STAFF FOLLOW ON QUESTIONS AND REVIEW STATUS, SSAR SECTION 9.5.1 - FIRE PROTECTION (June 24, 1996 letter).

9.5.1.6.5 Additional Features to Ensure Safe Shutdown Capability.

On SSAR Page 9A-5, Westinghouse states that fire-induced multiple high-impedance faults have been considered in the evaluation of safe shutdown capability. However, the SSAR does not explain how such faults which can compromise safe shutdown capability are eliminated in the AP600 design. This concern is RAI # 280.24 and is designated as Open Item 9.5.1.6-13.

Response:

The "Safe Shutdown Evaluation" subsections of SSAR Appendix 9A, Revision 8, include a description of the availability of safe shutdown capability. In general, these descriptions provide information about the redundant equipment that will be unaffected by the postulated fire. This approach applies to multiple high-impedance faults, as well as, hot shorts or other fire induced faults. As described, safe shutdown capability is maintained throughout the postulated fire scenario.

SSAR Revision: None

Question 280.25

Re: STAFF FOLLOW ON QUESTIONS AND REVIEW STATUS, SSAR SECTION 9.5.1 - FIRE PROTECTION (June 24, 1996 letter).

9.5.1.6.5 Additional Features to Ensure Safe Shutdown Capability.

On SSAR Page 9A.3.7.1.2, Westinghouse discusses how adverse consequences (i.e., affecting safe shutdown capability) due to spurious actuations other than those that involve high/low pressure interfaces are eliminated. The section indicates that these are eliminated by assigning separate integrated logic cabinets to two valves in series in a flow path (ADS valve actuations in any ADS flow path); operator actions (PCS valve actuation); redundant valves in series assigned to different electrical divisions which cannot be affected by the same fire (containment isolation valve actuation); or redundant sets of trip switchgear in separate fire areas (reactor trip switchgear and reactor coolant pump trip switchgear), as appropriate. Additionally, Westinghouse states in SSAR Section 9.A.3.1.1.15 that power to the normally open motor-operated PRHR heat exchanger inlet isolation valve located in Fire Zone 1100 AF 11590 is removed during normal power operation with the valve secured in the open position and thus fire-induced spurious actuation of this valve is eliminated. The staff finds the above acceptable, except the one for PCS valve spurious actuation. SSAR Page 9A-89 describes the manual actions to correct the consequences of fire-induced spurious actuation of a PCS valve. Since the SSAR described operator actions to eliminate adverse consequences of a PCS valve spurious actuation may involve accessibility to the affected fire zone (Fire Zone 1270 AF 12701), patrolling the fire zone and performance of the SSAR described corrective manual actions in a timely manner, it is not clear why AP600 fire protection system is not designed to eliminate the adverse consequences of fire-induced spurious actuation of a PCS valve without reliance on the SSAR described manual actions. This concern is RAI # 280.25 and is designated as Open Item 9.5.1.6-14.

Response:

SSAR Appendix 9A, subsection 9A.3.7.1.2, Revision 8, states that if one of the normally open PCS valves were to spuriously close, the redundant PCS water delivery flow path would be sufficient to achieve and maintain safe shutdown. Manual actions in an affected fire zone are not required.

Also note SSAR Appendix 9A, subsection 9A.3.1.1.18, Revision 8, states that if a normally closed PCS valve were to spuriously open as a result of a fire, there is no adverse impact on achieving and maintaining safe shutdown.

SSAR Revision: None

Question 280.26

Re: STAFF FOLLOW ON QUESTIONS AND REVIEW STATUS, SSAR SECTION 9.5.1 - FIRE PROTECTION (June 24, 1996 letter).

9.5.1.6.5 Additional Features to Ensure Safe Shutdown Capability.

SSAR Table 7.4-1 lists systems required for safe shutdown. SSAR Tables 9A-2, 9A-3 and 9A-4 list active safe shutdown valves, containment isolation valves inside the containment and containment isolation valves outside containment, respectively. SSAR Table 9A-5 lists the safe shutdown instrumentation provided in the MCR and RSS. Based on its review of the above tables, the staff finds that AP600 design provides for needed instrumentation both in the MCR and the RSS for achieving safe shutdown; however, the staff has the following concern regarding safe shutdown instrumentation:

1. On SSAR Pages 9A-14 and 9A-15, Westinghouse states that the majority of the transmitters for the RCS and the steam generator (SG) system associated with the instruments for the 2 cold legs and single hot leg are located outside the SG compartments (Fire Zone 1100 AF 11301 and 1100 AF 11302). However, the SSAR does not clarify whether: (a) this majority is sufficient to monitor process variables such as reactor coolant hot leg and cold leg temperatures; (b) the instruments will not be affected by fire and if so, why; and (c) the horizontal distance of these transmitters is at least 20 feet with no intervening combustibles from the associated fire zones. Also, it is not clear whether following a fire in one of the two SG compartments, the redundant instrumentation and transmitters for the unaffected SG compartment can be used to monitor the process variables. All these concerns are collectively classified as RAI # 280.26 and is designated as Open Item 9.5.1.6-15.

Response:

SSAR Appendix 9A, subsections 9A.3.1.1.10 and 9A.3.1.1.11, Revision 8, delineate the separation of fire zones 1000 AF 11301 and 1000 AF 11302 from each other and other fire zones. It also delineates the safe shutdown instrumentation contained in each zone and the location and function of redundant instrumentation in other fire zones. It also states that the unaffected instrumentation are sufficient to achieve and maintain safe sutdown. No further change to the SSAR is required.

SSAR Revision: None

Question 480.277

Re: (WGOTHIC MODELS AND PHENOMENA)ADEQUACY OF THE MIXED CONVECTION TREATMENT
The model used for mixed convection is defined in the report documenting the experimental basis for WGOTHIC heat transfer correlations ("Experimental Basis for the Heat Transfer Correlations Selected for Modeling Heat transfer from the AP600 Containment Vessel," PCS-GSR-004, Westinghouse Electric Corp., August 31, 1994). For opposed mixed and forced convection, the Nusselt number, Nuc is stated there to be given by

NUc = (NUfree**3 + NUforc**3)**(1/3)   (1)

where Nufree and Nuforc are the Nusselt numbers calculated for free and forced convection, respectively. For assisting mixed convection, the correlation is

NUc = Max((abs(NUfree**3 - NUforc**3))**(1/3);NUfree;0.75NUforc) (2)

No reason was given for applying the multiplier 0.75 to Nuforc but not to Nufree. Note also that Eq. (2) represents a change from the WGOTHIC mixed convection correlation as previously cited in response to NRC Question 480.14 (Ref. ET-NRC-93-3966, letter from N.J. Liparulo, Westinghouse responses to requests for additional information on the AP600, Question 480.14, September 10, 1993.) where in equation (4) both Nuforc and Nufree were multiplied by 0.75 based on the Eckert and Diaguila data base. A justification is required since Eq. (2) will never give Nuc less than Nufree while it seems to be well established that, in general, assisted mixed convection can give rise to heat transfer rates that are less than those implied by either free or forced convection correlations alone, when Nuforc Nufree....

In Eq. (2) above, what is WEC's justification for applying the multiplier 0.75 to Nufore but not to Nufree?

Response:

The 0.75 multiplier is applied to forced convection, and not free convection, because the Eckert and Diaguila Nusselt number measurements (Reference 480.277-1, Figure 4) show the mean free convection data line is a good nominal representation (although not a bounding representation) of the minimum heat transfer measurements. In contrast, the forced convection data (same figure) show a consistent Nusselt number drop of approximately 25% as the free convection line is approached, hence the 0.75 multiplier.

References:

480.277-1 E. R. G. Eckert and A. J. Diaguila, "Convective Heat Transfer for Mixed, Free, and Forced Flow Through Tubes", *Transactions of the ASME*, May, 1954, pp 497-504.

SSAR Revision: NONE

Question 480.287

Re: The accuracy of the WGOTHIC wall heat transfer approach for AP600 and LST analysis needs to be examined; the WGOTHIC correlation assumes that x=0 corresponds to the leading edge of a plate, while in AP600 and LST x=0 is actually a stagnation point.

Response:

Westinghouse has changed its approach to use a bounding evaluation model, which affects the applicability of the above question. The change in the evaluation model addressed the staff's previous concern.

The assumption for the evaluation model that the inside of containment operates in free convection eliminates the question of whether x = 0 represents a leading edge or stagnation point. The free convection model accurately predicted condensation mass transfer in LST with low Froude numbers (Reference 480.287-1) similar to those expected during post-blowdown LOCA. The mass transfer rate in the MSLB configuration tests with high Froude numbers was significantly under-predicted when free convection was assumed, since the forced convection mass transfer enhancement was neglected. The evaluation model conservatively assumes free convection throughout both LOCA and MSLB transients (Reference 480.287-2).

Mixed convection in the PCS air flow path is based on the channel hydraulic diameter as the characteristic length in both the Reynolds and Grashof numbers, so such ambiguities do not arise there. Although the evaluation model uses a mixed convection correlation in the annulus to allow transition from starting conditions, the correlation is dominated by forced convection after the shell surface heats to 2 °F above the ambient temperature (Reference 480.287-3).

References:

480.287-1 R. P. Ofstun, "Experimental Basis for the AP600 Containment Vessel Heat and Mass Transfer Correlations", WCAP-14326, March 31, 1995, Westinghouse Electric Corporation, Proprietary Class 2.

480.287-2 "AP600 PCS Design Basis Accident Road Maps," NTD-NRC-95-4545, August 31, 1995.

480.287-3 D. R. Spencer, "Supporting Information for the Use of Forced Convection in the AP600 PCS Annulus", NTD-NRC-95-4397, February 16, 1995.

SSAR Revision: NONE

Question 480.329

Re: (WGOTHIC MODELS AND PHENOMENA)DOWNCOMER
Can WEC demonstrate that the effects of a downcomer are adequately modeled?

Response:

The PIRT (Reference 480.329-1) and scaling analysis (Reference 480.329-2) provide rankings that show both the momentum and energy effects of the downcomer are minor. Consequently, it is sufficient to model the downcomer using ordinary phenomenological models and flow network. The downcomer is represented in the evaluation model as a series of connected lumped parameter volumes with mixed convection heat transfer to the baffle and shield building walls. The heat and mass transfer validation report (Reference 480.329-3) showed the lumped parameter model is adequate for modeling heat transfer in vertical channels. The evaluation model uses form loss coefficients measured in the 1/6 scale air flow test (Reference 480.329-4) that test was shown to be a valid representation of AP600 losses in the scaling analysis.

Additional information on the downcomer is provided in the response to RAI 480.330.

References:

480.329-1 D. R. Spencer, "Accident Specification and Phenomena Evaluation for AP600 Passive Containment cooling System", NSD-NRC-96-4643, February 12, 1996.

480.329-2 D. R. Spencer, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents," NSD-NRC-96-4762, July 1, 1996, Westinghouse Electric Corporation, Proprietary Class 2.

480.329-3 R. P. Ofstun, "Experimental Basis for the AP600 Containment Vessel Heat and Mass Transfer Correlations", WCAP-14326, March 31, 1995, Westinghouse Electric Corporation, Proprietary Class 2.

480.329-4 W. A. Stewart and A. T. Pieczynski, "Tests of Air Flow Path for Cooling the AP600 Reactor Containment", WCAP-13328, 1992, Westinghouse Electric Corporation, Proprietary Class 2.

SSAR Revision: NONE

Question 480.330

Re: (WGOTHIC MODELS AND PHENOMENA)DOWNCOMER

Does WEC consider that the effects of the downcomer are negligible, and if so how has this been demonstrated? How can the effects of a downcomer be quantified without experimental validation?

Response:

The effects of the downcomer on AP600 are quantified by the PIRT (Reference 480.330-1) and scaling analysis (Reference 480.330-2), and shown to be of low to moderate importance. The effect of the downcomer on AP600 is small, but is not negligible. The downcomer is modeled in the evaluation model.

The lack of a downcomer in the LST has no effect on the data that were used to validate phenomenological models or on the use of the LST pressure as a comparison to the evaluation model. This is true because the LST is not used as a transient representation of AP600. The data collected from the LST at numerous locations for heat and mass transfer to the riser provide measurements of heat flux, shell surface temperature, air temperature, and air steam partial pressure that are used to validate the heat and mass transfer correlations. This separate effects approach is not affected by the presence or absence of a downcomer.

The downcomer in the AP600 evaluation model is modeled as a channel operating with mixed convection thermal interactions with the shield building and baffle. The scaling analysis characteristic frequencies (Section 7.2.5, Baffle Outside) showed the energy transfer to the downcomer to be minor and the buoyancy contribution of the downcomer to the net PCS air flow path buoyancy (Table 8-1, G_{dc} /G_o) to be minor. The phenomena that occur in the downcomer were addressed in the PIRT and were all ranked low importance. Because the PIRT and scaling analysis showed the downcomer and its associated phenomena to be minor, it is sufficient to model the downcomer using ordinary analytical models.

References:

480.330-1 D. R. Spencer, "Accident Specification and Phenomena Evaluation for AP600 Passive Containment cooling System", NSD-NRC-96-4643, February 12, 1996.

480.330-2 D. R. Spencer, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents," NSD-NRC-96-4762, July 1, 1996, Westinghouse Electric Corporation, Proprietary Class 2.

SSAR Revision: NONE

Question 480.378

Re: (The following question is based on the WEC March 29-30, 1995 ACRS Presentation on Scaling). Provide the basis for the "well mixed" assumption including a discussion of the apparent inconsistency of this assumption based on data and calculation (in terms of the Froude number).

Response:

The "well-mixed" assumption made the scaling analysis tractable utilizing simple analytical methods. The containment atmosphere is expected to stratify, and mixing within and between compartments may not be sufficient to achieve a well mixed containment. The LST concentration measurements showed that stratification and less than perfect mixing are typical. In AP600, deviations from well-mixed will affect the energy absorbed by internal heat sinks and the containment shell.

The consequences of deviations from a well-mixed containment are addressed in the mixing and stratification report (Reference 480.378-1) The conclusions of that report provide bases for biasing the evaluation model to account for actual limits on mixing and stratification in AP600.

References:

480.378-1 J. S. Narula, "Assessment of Mixing and Stratification Effect on AP600," NSD-NRC-96-4763, July 1, 1996.

SSAR Revision: NONE

Question 480.379

Re: (The following questions are based on the WEC March 29-30, 1995 ACRS Presentation on Scaling). Where does the "U" in the correlations come from when the main steam line break (MSLB) is being analyzed? How were equations derived, what assumption were used?

Response:

The containment rate of pressure change equation is derived from the energy equation for the containment gas. The energy equation for the containment gas is derived from the energy equation for a control volume which relates the internal energy, u, to the enthalpy fluxes and heat fluxes through the control surface. The derivation of the energy and rate of pressure change equations for the scaling analysis are presented in Appendix A of the scaling report (480.379-1).

References:

480.379-1 D. R. Spencer, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents," NSD-NRC-96-4762, July 1, 1996, Westinghouse Electric Corporation, Proprietary Class 2.

SSAR Revision: NONE

Question 480.380

Re: The following questions are based on the WEC March 29-30, 1995 ACRS Presentation on Scaling.
The Large-Scale Test air-annulus was scaled by matching Reynolds (Re) numbers. This tends to result in higher heat transfer and more vigorous in-containment convection than might be expected in the AP600. It would seem that scaling to the following form would be more appropriate:

integral (q dA / v)

What are the ramifications?

Response:

The scaling analysis (Reference 480.380-1) demonstrated that the Reynolds number is the appropriate dimensionless group to use to scale evaporation mass transfer and heat transfer to the riser.

References:

480.380-1 D. R. Spencer, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents," NSD-NRC-96-4762, July 1, 1996, Westinghouse Electric Corporation, Proprietary Class 2.

SSAR Revision: NONE

Question 480.396

Re: Reference 3 of Ref. 3 is the March 29-30, 1995 ACRS meeting of the thermalhydraulic phenomena subcommittee. To the extent that the information presented at this meeting is being used to support the PIRT, as noted on page 1-2 of Ref. 3, provide a written discussion and include copies of the relevant presentation material. In part, it appears that the material provided to the ACRS supports the PIRT in Table 7-3 on page 7-7 of Ref. 3 which differs from Table 2-1 on page 2-10 of WCAP-14190.

Reference:

3. "WGOTHIC Code Description and Validation," WCAP-14382, May 1995.

Response:

The references of this RAI were superseded by revised PIRT (Reference 480. .5-1) and scaling analysis (Reference 480.396-2) documents.

References:

480.396-1 D. R. Spencer, "Accident Specification and Phenomena Evaluation for AP600 Passive Containment cooling System", NSD-NRC-96-4643, February 12, 1996.

480.396-2 D. R. Spencer, "Scaling Analysis for AP600 Containment Pressure During Design Basis Accidents," NSD-NRC-96-4762, July 1, 1996, Westinghouse Electric Corporation, Proprietary Class 2.

SSAR Revision: NONE