

Docket File



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 20, 1997

Mr. Nicholas J. Liparulo, Manager
Nuclear Safety and Regulatory Activities
Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
P O. Box 355
Pittsburgh, PA 15230

SUBJECT: FOLLOWON QUESTIONS REGARDING THE WESTINGHOUSE AP600 INITIAL TEST
PROGRAM (ITP)

Dear Mr. Liparulo:

As a result of its review of the June 1992 application for design certification of the AP600, the staff has determined that it needs additional information. Specifically, the enclosures to this letter contain information regarding the AP600 ITP. Enclosure 1 to this letter contains the status of some of the Open Items related to the ITP, and the staff's evaluations of these items. Enclosure 2 to this letter contains followon questions related to the ITP.

You have requested that portions of the information submitted in the June 1992, application for design certification be exempt from mandatory public disclosure. While the staff has not completed its review of your request in accordance with the requirements of 10 CFR 2.790, that portion of the submitted information is being withheld from public disclosure pending the staff's final determination. The staff concludes that these followon questions do not contain those portions of the information for which exemption is sought. However, the staff will withhold this letter from public disclosure for 30 calendar days from the date of this letter to allow Westinghouse the opportunity to verify the staff's conclusions. If, after that time, you do not request that all or portions of the information in the enclosures be withheld from public disclosure in accordance with 10 CFR 2.790, this letter will be placed in the Nuclear Regulatory Commission Public Document Room.

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Mr. Nicholas J. Liparulo

- 2 -

March 20, 1997

If you have any questions regarding this matter, you may contact me at
(301) 415-1132.

Sincerely,

original signed by:

Joseph M. Sebrosky, Project Manager
Standardization Project Directorate
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Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: As stated

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Docket No. 52-003
AP600

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Westinghouse AP600 SSAR Chapter 14. Initial Test Program

Background: In a letter dated December 11, 1996, the staff provided Westinghouse with responses to various outstanding requests for additional information (RAIs) and Draft Safety Evaluation Report (DSER) open items for the AP600 Standard Safety Analysis Report (SSAR) Chapter 14, Initial Test Program (ITP). These issues are being tracked by both Westinghouse and the staff in the AP600 Open Items Tracking System (OITS).

The result of the staff's review of outstanding AP600 Chapter 14 OITS Open Items that remain open, confirmatory or "Action N" is described below (closed items have been included only if the item was previously identified in the staff's December 11, 1996, letter to Westinghouse). The status that follows does not include the status of RAI 260.90 that was issued to Westinghouse in a December 19, 1996, letter. In addition, Enclosure 2 contains several new issues that have been identified by the staff during their review of the ITP.

This review encompasses changes incorporated in Chapter 14 as a result of Revision 11 to the SSAR. In the very near future, the staff intends to provide Westinghouse with the status of the remaining AP600 OITS which are now being considered for closure or which are still categorized as "Action N".

- ❑ **OITS 780/DSER Open Item 3.9.2.1-1:** In the DSER, the staff found that in order to be consistent with the guidance in Subsection 3.9.2 of the SRP, the systems to be monitored during preoperational vibration and dynamic effects testing tests should include:
- ASME Code, Class 1, 2, and 3 piping
 - high-energy piping systems inside seismic Category I structures
 - high-energy portions of systems whose failure could reduce the functioning of seismic Category I plant features to an unacceptable safety level
 - seismic Category I portions of moderate-energy piping systems located outside the containment

In partial response to DSER Open Item 3.9.2.1-1, Revision 4 to the SSAR revised Subsection 3.9.2.1 to add a commitment to include all of the piping systems listed above in the AP600 piping vibration, thermal expansion, and dynamics effects testing programs. Additionally, in its August 13, 1996, response to the NRC, Westinghouse stated that "Subsection 14.2.9.1.7, has been revised to state that the AP600 preoperational piping vibration, thermal expansion, and dynamics testing will include ASME Code Class 1, 2, and 3; i.e., safety related high energy piping system components, piping, and piping support and restraint devices."

Enclosure 1

In Revision 11 of SSAR Chapter 14, Section 14.2.9.1.7, under "General Test Method and Acceptance Criteria," only ASME Class 1, 2, and 3 piping systems will be tested. Sections 14.2.10.4.18 and 14.2.10.4.25 contain a broad commitment to test "essential NSSS and balance of plant components." In order to remain consistent with SRP 3.9.2 and SSAR Section 3.9.2.1, Westinghouse needs to revise Sections 14.2.9.1.7, 14.2.10.4.18 and 14.2.10.4.25 to include a commitment that the four types of systems listed above will be monitored during piping thermal expansion, vibration, and dynamic effects testing. Therefore, the Chapter 14 part of DSER Open Item 3.9.2.1-1 remains open.

- OITS 1124/DSER Open Item 9.5.1.4-7: In Subsection 9.5.1.4.8, "Preoperational Testing," of the DSER, the staff found that additional information was required from Westinghouse to establish the acceptability of the fire protection system(s) preoperational test program in complying with Section C.4.e of BTP CMEB 9.5-1. This issue was identified as DSER Open Item 9.5.1.4-7.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Subsection 14.2.9.2.8, Fire Protection System Testing, has been revised to state that the system operates as specified in Subsection 9.5.1 and in appropriate design specifications. These documents identify the applicable NFPA standards for the testing of individual components in the fire protection system. Subsection 14.2.9.2.19 and 14.2.9.4.13 describe testing of the plant lighting and communication systems, respectively. The breathing apparatus provided at the plant and the use of this equipment will be identified by the COL applicant, as part of the fire protection personnel training."

In Revision 11 to the AP600 SSAR Chapter 14, Subsection 14.2.9.2.8, "Fire Protection System Testing," under "General Test Method and Acceptance Criteria," Westinghouse stated "The following testing demonstrates that the system performs its defense-in-depth functions specified in Subsection 9.5-1 and as specified in appropriate design specifications:

The capability of the seismic standpipes to supply the required fire water quantity and flow rate is verified."

The staff disagrees with Westinghouse's conclusion that verifying that the seismic standpipes can supply the required fire water quantity and flow rate demonstrates that the fire protection system "performs its defense-in-depth functions specified in Subsection 9.5-1 and as specified in appropriate design specifications". Westinghouse needs to modify this subsection to encompass testing of the AP600 fire protection system in an integrated manner, i.e., fire doors, fire dampers, smoke control systems, automatic fire detection underground fire main, fire pumps, automatic suppression systems, electrical isolation devices for non-safety related equipment in opposite divisional fire areas, and trained fire brigade.

This is to insure that a strong and reliable fire protection program is available to fight, contain and extinguish any type of fire prior to fuel load.

Additionally, Westinghouse needs to incorporate the other subsystems in the Initial Test Program to insure:

- (1) Fire detection will be available to detect fires in their incipient stage and alert key personnel of fire conditions.
- (2) Fire barriers, fire walls, fire dampers and smoke control systems limit spread of fire and smoke.
- (3) Fire pumps, underground fire main and water supply system will be available to provide a strong water supply to fight fires in safety related areas and non-safety related areas.
- (4) Fire Brigade will be adequately trained to fight fires including electrical and flammable liquid type fires.

The integration of these systems ensures a strong Defense-in-Depth system that provides an acceptable level of fire protection for the AP600 Advance Reactor. Therefore, OITS 1124/DSER Open Item 9.5.1.4-7 remains open.

□ OITS 1162/DSER Open item 10.4.7-1(RAI 410.263):

In the DSER, the staff found that Westinghouse should provide procedures for testing feedwater hammer occurrence. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.7, "Expansion, Vibration and Dynamic Effects Testing," was revised to include testing to start/stop startup feedwater to the steam generators to verify that unacceptable feedwater hammer does not occur. Staff review of this section determined that it does not provide sufficient information for testing feedwater hammer occurrence. Additionally, Section 14.2.9.2.2, "Main and Startup Feedwater System," should be modified to include the following:

- a) perform FW system test and monitor that no effects due to water hammer are detected.
- b) check for water hammer noise and vibration using suitable instrumentation.
- c) visual inspection indicates that the integrity of FW piping, support, and feeding have not been violated.

Therefore, OITS 1162/DSER Open item 10.4.7-1 remains open.

- OITS 1234/DSER Open Item 14.2.1-1: In the DSER, the staff found that in order to be consistent with the guidance of Regulatory Position (RP) C.1 of RG 1.68, Revision 2, dated August 1978, the third, fourth, and fifth paragraphs in Section 14.2.1 of the SSAR, regarding systems on which preoperational and/or startup testing is to be performed, should be revised as follows:

- Are relied upon for establishing conformance with safety limits or limiting conditions for operation that will be included in the facility technical specifications
- Are classified as ESFASs or are relied upon to support or ensure operation of ESFASs within design limits
- Are assumed to function or for which credit is taken in the accident analysis of the facility, as described in the SSAR, and/or in its design-specific PRA

In addition, Westinghouse was requested to include, in this section of the SSAR (or in another Chapter 14 section, as appropriate), a detailed description of those AP600 plant-specific design features, systems (including those listed in Table 1.5-1 of the SSAR), and/or system configurations or interactions, not being tested and/or simulated within the initial test program scope of Chapter 14 of the SSAR, which met either of the following criteria:

- are significantly different from those found in light water reactor designs described in 10 CFR 52.47(b)(1)
- utilize simplified, inherent, passive, or other innovative means to accomplish their intended safety functions.

For any such systems or design features identified, Westinghouse was requested to provide appropriate justifications for their exclusion from the ITP, or that the applicable test abstract(s) be modified to encompass them accordingly. The staff also found that Section 14.2.1 (or alternatively Section 14.2.8) of the SSAR should be revised to identify, if applicable, any startup tests to be performed to demonstrate the operability of structures, systems, and components that are not considered essential to meet the criteria of RP C.1 of RG 1.68 (Revision 2, dated August 1978).

Portions of these issues had been previously identified by the staff as Q260.23. This was identified as DSER Open Item 14.2.1-1.

In its July 8, 1994 response to RAI 260.23, Westinghouse confirmed that there were no tests in Chapter 14 which demonstrated the operability of structures, systems, and components that are not considered essential to

meet the criteria of RP C.1 of RG 1.68. Westinghouse also agreed to revise the third, fourth, and fifth paragraphs in Subsection 14.2.1 of the SSAR, as indicated by the staff in the DSER.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Subsection 14.2.1, has been revised to include the test objectives identified in the August [July] 8, 1994, response to RAI 260.23. In addition, test abstracts for applicable systems identified in Regulatory Guide 1.68, Revision 2, Appendix A have been included." The staff agreed that Westinghouse had been responsive to the issues identified in this open item, except for the following:

- a. In Revision 9 to the SSAR, the AP600 design-specific PRA had not been included in (currently) subparagraph 14.2.1(e).
- b. Westinghouse had not addressed whether Section 14.2.1, Paragraph (g) needs to be revised to reflect Westinghouse's response to this Open Item that "applicable systems" identified in RG 1.68 had been included (as stated above) or justify why only nonsafety-related SSCs in the RG were "applicable to AP600" as indicated in the current SSAR revision. If the intent of paragraph (g) was to include any remaining SSCs included in RG 1.68, Appendix A, not identified in the paragraphs (a) through (f), this item should have been clarified accordingly.
- c. During its ongoing review, the staff will determine if the current (Revision 9) ITP conclusively covers all AP600 plant-specific design features, systems (including those listed in Table 1.5-1 of the SSAR), and/or system configurations or interactions which meet either of the following criteria: (1) are significantly different from those found in light water reactor designs described in 10 CFR 52.47(b)(1), or (2) utilize simplified, inherent, passive, or other innovative means to accomplish their intended safety functions. Therefore, these portions of DSER Open Item 14.2.1-1 remained open.

In its December 6, 1996 response, Westinghouse stated the following:

- "a. Westinghouse did not use the design specific PRA as a criteria for selection of systems, structures or components to be included in the ITP. However, applying this criteria does not capture any additional AP600 SSC not currently captured by the criteria currently provided in Section 14.2.1. Therefore, Westinghouse does not believe it is necessary to add a reference to the design PRA as a criteria for test selection.
- b. Item 14.2.1(g) will be revised as follows:

"Other systems identified in RG 1.68 Rev. 2 App. A that are in the AP600 and are not captured by criteria a) through f)."

- c. Table 1.5-1 of the SSAR lists specific AP600 design tests that have been performed to assess the performance of components and systems in the AP600 and does not represent a comprehensive list of design features, per se, in the AP600 that are significantly different from currently operating light water reactors or utilize passive systems. However, Westinghouse believes that those design features embodied in the design tests listed in Table 1.5-1 that meet the criteria listed in item c of the staff's response are conclusively tested as part of the AP600 Initial Test Program described in Chapter 14 of the SSAR.

The staff agrees with Westinghouse's position in (a), and confirmed that Revision 11 of Chapter 14 includes the language described in (b). With regards to item (c), any AP600 plant-specific design feature identified by the staff during its comprehensive review of Chapter 14 as not being conclusively covered in the ITP, will be identified and tracked separately. Therefore, OITS 1234/DSER Open Item 14.2.1-1 is closed.

- OITS 1236/DSER Open Item 14.2.2-2: In the DSER, the staff found that Section 14.2.2 of the SSAR should be revised to clarify that Westinghouse will provide the COL applicant with scoping documents (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to Westinghouse's scope of design responsibility. Such documents should also include, as appropriate, delineation of the following testing information: (a) specific plant operational conditions under which the tests will be conducted, (b) testing methodologies to be used, (c) specific data to be collected, (d) acceptable data reduction techniques, and (e) any reconciliation methods needed to account for test conditions, methods, or results (if testing is performed at conditions other than representative design operating conditions).

The staff also found that this section (and/or Section 14.2.9, as appropriate) should include the following COL action items to be provided by the prospective COL applicant for staff review: (a) the scoping document (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to Westinghouse's scope of design responsibility. This was identified as COL Action Item 14.2.2-1; (b) the scoping document, and any related documents, which delineate plant operational conditions at which tests are to be conducted, testing methodologies to be utilized, specific data to be collected, and acceptable data reduction techniques to be utilized. This was identified as COL Action Item 14.2.2-2; (c) the scoping document that delineates any reconciliation methods needed to account for test conditions, methods, or results if testing is performed at conditions other than representative of design operating conditions. This was identified as COL Action Item 14.2.2-3; and (d) the approved preoperational test procedures (to be provided approximately 60 days before their intended use, and startup test procedures (to be provided

approximately 60 days before fuel loading). This was identified as COL Action Item 14.2.2-4 (These issues were previously identified by the staff in Q260.24). This was identified as Open Item 14.2.2-2.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Information to be provided by the COL, related to the plant initial test program, has been added to the SSAR in Section 14.4." Although not specifically acknowledged in this response, Westinghouse's previous response to Q260.24 was provided in their July 22, 1994, letter to the NRC. In this letter, Westinghouse had stated, in part, that "It is inappropriate for the SSAR to specify the specific form the designers and/or equipment suppliers must supply the information. The optimum form may evolve with information technology and lessons learned from initial plants."

In its November 8, 1996, response to Westinghouse, the staff stated that SSAR Section 14.4, "Combined License Applicant Responsibilities," Subsections 14.4.2, "Test Specifications and Procedures" and 14.4.3, "Conduct of Test Program" both assert that the COL applicant is responsible for (1) providing test procedures for the preoperational and startup tests for NRC review, and (2) formulating the startup administration manual (procedure) which contains the administration procedures and requirements that govern the activities associated with the plant initial test program, as identified Subsection 14.2.3, "Test Procedures."

However, the staff noted that Subsection 14.2.3 does not address the responsibility of the COL applicant in preparing the following: (a) the scoping document (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to Westinghouse's scope of design responsibility, and (b) the scoping document that delineates any reconciliation methods needed to account for test conditions, methods, or results if testing is performed at conditions other than representative of design operating conditions. *(These COL applicant areas of responsibility are stipulated under Subsection 14.2.3, "Test Procedures," Section 14.2, "Specific Information To Be Included in Final Safety Analysis Reports," of Regulatory Guide (RG) 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," Revision 3).*

The staff also clarified that the purpose of Q260.24 and Q260.28 was not to dictate or specify the "specific form the designers and/or equipment suppliers must supply the information." Rather, the issue at hand is the need to explicitly identify and define specific documented information (i.e., "scoping documents" as defined above) that the prospective COL applicant must provide for staff review. Therefore, these portions of DSER Open Item 14.2.2-2 remained open.

In its December 6, 1996 response, Westinghouse stated the following:

"Section 14.2.3 will be retitled - Test Specifications and Procedures. The contents of current 14.2.3 as currently written applies to either Test Specs or Test Procedures (or both). Test Procedures will be modified to read Test Specifications and/or Procedures where appropriate. A paragraph describing the contents of the test specifications will be provided which includes:

'Criteria for test results evaluation and reconciliation methods and analysis as required.'

Test specifications or test procedures for each test performed during the Initial Test Program include testing objectives and acceptance criteria for each test." (Proposed SSAR Revision: Pages 14.2-4 and 14.2-5).

The staff found that the proposed SSAR revisions, while providing needed clarification and aiding in the resolution of other issues, do not address the COL applicant issues identified in items (a) and (b), above. Therefore, DSER Open Item 14.2.2-2 remains open.

- OITS 1238/DSER Open Item 14.2.2.2-1: In the DSER, The staff stated that this section (and/or Section 14.2.9, as appropriate) should include the following COL action items to be provided by the prospective COL applicant for staff review: the scoping document (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to Westinghouse's scope of design responsibility. This was identified as COL Action Item 14.2.2-1.

In its August 13, 1996 response to the NRC, Westinghouse stated that "COL Action Items related to the plant initial testing program have been added to the SSAR in Section 14.4."

The staff finds this item confirmatory pending resolution of DSER Open Item 14.2.2-2, above.

- OITS 1244/DSER Open item 14.2.8-6(RAI 260.26):

In the DSER, the staff found that Westinghouse should provide testing of the main control room emergency habitability system on subsequent AP600 plants. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.6, "Main Control Room Emergency Habitability System Testing," was revised to include appropriate testing for each plant, but that a long-term demonstration of this system would be conducted only for the first plant.

Staff review of this section determined that sufficient assurance does not exist to conclude that the heat loads in the main control room area are identical for all AP600 plants. Therefore, Section 14.2.9.1.6 should

be modified to include applicability of this testing to subsequent AP600 plants, or Appendix 1A in the SSAR should provide appropriate justification for this exception to RG 1.68, Appendix A, Item 1.n.(14)(f). OITS 1244/DSER Open item 14.2.8-6 remains open.

- OITS 1245/DSER Open Item 14.2.8-7: In the DSER, the staff found that in startup test Abstract 14.2.8.2.34, Westinghouse had taken exception to RG 1.68 for testing natural circulation as had been done for current pressurized water reactor (PWR) plants. The justification for this exception was that the performance of a natural circulation test was not necessary to demonstrate flow characteristics of the plant. The physical layout of the plant and key components (steam generators, pumps, piping, and reactor vessel) remain identical for each unit. Typical manufacturing and construction variations in these parameters would have no significant impact on the natural circulation flow. Since the design and layout is fixed between each AP600 plant, no changes in the natural circulation characteristics would occur. Other system flow and performance measurements taken during the hot functional and power ascension testing would provide assurances that the overall flow characteristics of the plant are equivalent to the reference plant. Therefore, demonstration of the natural circulation characteristics on the first AP600 plant would be sufficient to validate the design characteristics. The natural circulation test is prototypical.

The staff found this response would be acceptable for startup test Abstract 14.2.8.2.34, provided that the following criteria were met: (1) Appropriate justification for this exception to RG 1.68, Appendix A, Item 4.t, is included in Appendix 1A of the SSAR, or Section 1.9.3 of the SSAR, as appropriate. (This justification should provide appropriate reference to Westinghouse's response for NUREG-0737, action Item I.G.1, as described in the attachments to the letter from Westinghouse (E.P. Rahn) to the NRC (H.R. Denton), dated July 8, 1981); and (2) Westinghouse identifies this issue, in Section 14.2.9 of the SSAR (or its subsequent equivalent), as a COL action item, which will require COL applicants referencing the AP600 design to perform the following: (a) demonstrate that the physical layout and configuration of the proposed plant and key components (steam generators, pumps, piping, and reactor vessel) remain identical to the reference plant; (b) validate the acceptance criteria, provided by Westinghouse, for the specific values or ranges of values for other system flow and performance measurements that are to be taken during the hot functional and power ascension testing to confirm that the overall flow characteristics of the proposed plant are equivalent to the reference plant. This was identified as COL Action Item 14.2.8-1 and as Open Item 14.2.8-7.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.3 provides reference to Certified Design Material which commits the COL to conduct the Initial Test Program. As part of that Initial Test Program, the COL will verify the physical layout and

configuration of the components, and component parameters important to the natural circulation of fluid in the reactor coolant system. These verifications will establish that AP600 plants subsequent to the first plant, will achieve natural circulation flow similar to the flow demonstrated by testing in the first plant."

In its November 8, 1996, response to Westinghouse, the staff clarified that while the Certified Design Material (CDM) provides that the COL conduct certain testing to satisfy ITAAC requirements, the CDM does not commit the COL to conduct the Initial Test Program. § 50.34, Appendix A to 10 CFR Part 50, and Section XI, "Test Control," of Appendix B to 10 CFR Part 50 require that a test program be established to ensure that structures, systems, and components will perform satisfactorily in service.

In order to address the staff's concerns on this issue, Westinghouse would need to (1) confirm that the ITAAC process will (a) demonstrate that the physical layout and configuration of the proposed plant and key components (steam generators, pumps, piping, and reactor vessel) remain identical to the reference plant; (b) validate the acceptance criteria, provided by Westinghouse, for the specific values or ranges of values for other system flow and performance measurements that are to be taken during the hot functional and power ascension testing to confirm that the overall flow characteristics of the proposed plant are equivalent to the reference plant; and (2) include appropriate justification for this exception to RG 1.68, Appendix A, Item 4.t, in Appendix 1A of the SSAR, or Section 1.9.3 of the SSAR, accordingly. (This justification should provide appropriate reference to Westinghouse's response for NUREG-0737, action item I.G.1, as described in the attachments to the letter from Westinghouse (E.P. Rahe) to the NRC (H.R. Denton), dated July 8, 1981); otherwise, Westinghouse should commit to performing the requisite natural circulation testing in accordance with RG 1.68, Appendix A, Item 4.t. DSER Open Item 14.2.8-7 remained open.

In its December 6, 1996 response, Westinghouse stated the following:

"Section 3.4 of the AP600 CDM as submitted for staff review on November 8, 1996, contains a high level commitment to perform an Initial Test Program by the COL applicant."

Justification for this exception will be provided in Appendix 1A of the SSAR citing the appropriate reference and stating the rationale:

'For the AP600, natural circulation heat removal is not safety-related, as in current plants. This safety-related function is performed by the PRHR. Natural circulation heat removal via the PRHR is tested for every plant. Therefore, Westinghouse has met the intent of the previous licensing commitments for natural circulation testing.'

This justification will be provided in Section 1.9.3 of the SSAR. W response to NUREG-0737, Action Item I.G.1 provided a proposal for low power testing of existing and future W PWRs in Attachment 4 to the letter from Westinghouse (E. P. Rahe) to the NRC (H. R. Denton) dated July 8, 1981. For the AP600, W proposes the following similar exception; noting that the appropriate tests are contained in the AP600 ITP:

1. During hot functional testing, prior to fuel load, with the reactor coolant pumps not running and no onsite power available, the heat removal capability of the PRHR heat exchanger with natural circulation flow is verified (Section 14.2.9.3, item e).
2. After fuel loading, but prior to criticality, with the reactor system at no-load operating temperature and pressure and all RCPs operating, the depressurization rate is determined by de-energizing the heaters and pressure is further reduced through use of sprays (Section 14.2.10.1.19).
3. After criticality is achieved and the plant is at ~ 3 percent power, the plant is placed in a natural circulation mode by tripping all reactor coolant pumps and observing the plant response (Section 14.2.10.3.6).
4. A loss-of-offsite power test is performed with the plant at minimum power level supplying normal house loads. The turbine is tripped and the plant is placed in a stable condition using batteries and the diesel generator (Section 14.2.10.4.26).
5. Data obtained from the natural circulation tests is provided for operator training on a plant simulator at the earliest opportunity.

The staff finds Westinghouse's response on the NUREG-0737, Action Item I.G.1 issue acceptable. However, Westinghouse has not provided adequate justification or information in the SSAR for the staff to conclude that the ITAAC process will (a) demonstrate that the physical layout and configuration of the proposed plant and key components (steam generators, pumps, piping, and reactor vessel) remain within the specified tolerances of the reference plant; and (b) validate the acceptance criteria, provided by Westinghouse, for the specific values or ranges of values for other system flow and performance measurements that are to be taken during the hot functional and power ascension testing to confirm that the overall flow characteristics of the proposed plant remain within the accepted bounds of the reference plant.

Additionally, Subsection 1.9.4.2.1, Item I.G.1, indicates that the passive residual heat removal (PRHR) system fulfills the natural circulation heat removal function for the AP600. Therefore, Subsection 14.2.10.3.6, "Natural Circulation," should be modified to conduct natural circulation testing with the PRHR. Otherwise, testing conducted under Subsection 14.2.9.1.3, "Passive Core Cooling System Testing,"

should be conducted in every plant provided that such testing is performed at conditions necessary and sufficient to demonstrate design and operating system parameters commensurate with those that would have been demonstrated by testing at conditions described under Subsection 14.2.10.3.6. If the latter testing option is selected, Westinghouse would also need to modify its response to NUREG-0737, Action Item I.G.1, accordingly. Therefore, OITS 1245/DSER Open Item 14.2.8-7 remains open.

- OITS 1247/DSER Open Item 14.2.8-9: In the DSER, the staff found that Westinghouse should modify startup test Abstract 14.2.8.2.41 in Appendix 1A of the SSAR to include applicability of this testing to subsequent AP600 plants, or provide appropriate justification for this exception to RG 1.68, Appendix A, Item 5.j.j. This was identified as Open Item 14.2.8-9.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Chapter 14 has been revised to delete testing which simulates a loss of off-site electrical power with the reactor core at power, however, each aspect of a loss of off-site power transient is tested separately. These tests include the RCP flow coastdown test (14.2.10.1.18), the diesel generator start, and load testing (14.2.9.2.17), the rod control system test (14.2.10.1.11), and the rod drop time measurement test (14.2.10.1.14)."

In its November 8, 1996, response to Westinghouse, the staff found Westinghouse's justification for deleting testing to demonstrate that the dynamic response of the plant is in accordance with design for the condition described in RG 1.68, Appendix A, Item 5.j.j unacceptable. While results obtained when performing discrete systems tests at separate intervals may be indicative of the overall expected plant behavior during postulated operational transients, such testing is not a substitute for demonstrating that the actual dynamic plant response, including anticipated systems interactions, is in accordance with design during a simulated or actual transient. The staff concluded that Westinghouse should revise Chapter 14 to reinstate testing for the condition described in RG 1.68, Appendix A, Item 5.j.j. Therefore, DSER Open Item 14.2.8-9 remained open.

In its December 6, 1996 response, Westinghouse stated that "This test will be included as section 14.2.10.4.26."

The staff finds the reinstatement of testing for the condition described in RG 1.68, Appendix A, Item 5.j.j. under section 14.2.10.4.26 of Revision 11 to the SSAR acceptable. Therefore, OITS 1247/DSER Open Item 14.2.8-9 is closed.

- OITS 1249/DSER Open Item 14.2.8-11: In the DSER, the staff found that Startup test Abstract 14.2.8.2.51 should be modified in Appendix 1A of

the SSAR to include applicability of this testing to subsequent AP600 plants, or to provide appropriate justification for this exception to RG 1.68, Appendix A, Item 5.n.n.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Subsection 14.2.10.4.21 specifies that the 100 percent load rejection test is to be performed only on the first AP600 plant. This testing provides measurements of the plant parameters including reactor power and primary and secondary pressures and temperatures that occur following this transient. Subsequent plants have similar equipment, control systems, and setpoints. The above first-plant-only test meets the following criteria used to establish which testing is to be performed only on the first AP600 plant: (a) the performance parameter(s) to be measured is not provided by previous certification, qualification, or prototype testing; and (2) construction and installation inspections and other preoperational tests, performed on every plant, demonstrate that the performance parameter(s) does not change from plant to plant."

In its November 8, 1996, response to Westinghouse the staff found that Westinghouse's justification for not demonstrating that the dynamic response of the plant is in accordance with design for the condition described in RG 1.68, Appendix A, Item 5.n.n., on all subsequent plants was unacceptable.

The staff added that RG 1.68, Appendix A, Item 5.n.n., provides for the demonstration that the dynamic response of the plant is in accordance with design for the case of a full load rejection transient with the plant's electrical distribution system aligned for normal full power operation, and in such a manner that the turbine-generator is subjected to the maximum credible overspeed condition. While the staff may agree that subsequent AP600 plants have similar equipment, control systems, and associated setpoints, this test is not conducted just to demonstrate that the performance parameters do not change from plant to plant. Rather, the purpose of this test is to demonstrate that the integrated dynamic response of the as-built plant, including all associated systems and/or design features, conforms to the postulated plant response when subjected to this anticipated transient. Therefore, Subsection 14.2.10.4.21 needs to be modified to include applicability of this testing to subsequent AP600 plants. DSER Open Item 14.2.8-11 remained open.

In its December 6, 1996 response, Westinghouse stated that "This test will be performed on every plant."

The staff found Westinghouse's response acceptable and, therefore, OITS 1249/DSER Open Item 14.2.8-11 was considered confirmatory pending formal submittal of Revision 10 to SSAR Chapter 14.

In Revision 10 (and subsequently in Revision 11) of the SSAR, Subsection 14.2.10.4.21, "100 percent Load Rejection," which is to be conducted on each plant, is an external load rejection test which would not subject

the turbine to the maximum credible overspeed condition. RG 1.68, Appendix A, Item 5.n.n, specifies that a full load rejection test be conducted on each plant and that the test should subject the turbine to the maximum credible overspeed condition. Therefore, Subsection 14.2.10.4.21, or other test abstract as appropriate, should be modified to test the full (external and internal) load rejection capability of each plant. OITS 1249/DSER Open Item 14.2.8-11 remains open.

❑ OITS 1251/DSER Open item 14.2.8-13 (RAI 260.26):

In the DSER, the staff found that Westinghouse should conduct a turbine trip test on subsequent AP600 plants. Westinghouse responded in their August 13, 1996, letter that Section 14.2.10.4.24, "Plant Trip from 100 percent Power," will be conducted on each plant. Staff review of this section determined that this test is initiated by a reactor trip, not a turbine trip. This test, or other test abstracts, should be modified to test the turbine trip response of all AP600 plants, or Appendix 1A in the SSAR should provide appropriate justification for this exception to RG 1.68, Appendix A, Item 5.1.1. Alternatively, consideration should be given to initiating the full load rejection testing described in Section 14.2.10.4.21 by a main generator breaker trip so that it could be conducted in lieu of the plant trip test described in Section 14.2.10.4.24. This is acceptable in that RG 1.68, Appendix A, Item 5.1.1 specifies that a turbine trip test can be combined with testing in accordance with Item 5.n.n, if the test is initiated by a main generator breaker trip. OITS 1251/DSER Open item 14.2.8-13 remains open.

❑ OITS 1252/DSER Open Item 14.2.8-14: In the DSER, the staff found that Westinghouse should revise Section 14.2.8 of the SSAR to reconcile its contents with that of Section 14.2.2 of the SSAR, as discussed above in relation to Q260.24.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Responses to RAIs 260.24 and 260.28 have been provided [July 22, 1994, letter to NRC]. Section 14.4 has been revised to specify the COL provide appropriate initial test program documents for review by the staff."

In its November 8, 1996, response to Westinghouse, the staff concluded that the closure of this issue was contingent upon the satisfactory resolution of OITS 1236/DSER Open Item 14.2.2-2, above. In its December 6, 1996, response, Westinghouse concurred with the staff's conclusion. Therefore, OITS 1252/DSER Open Item 14.2.8-14 is confirmatory pending satisfactory resolution of OITS 1236/DSER Open Item 14.2.2-2.

❑ OITS 1253/DSER Open Item 14.2.8-15: In the DSER, the staff found that Westinghouse should revise Section 14.2.8 of the SSAR, as well as the individual test methods or performance criteria, to provide specific references to the basis for determining acceptable system and component performance.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Subsection 14.2.9 has been revised to specify specific references that should be used to determine acceptable system and component performance."

In its November 8, 1996, response to Westinghouse, the staff concluded that Westinghouse had not satisfactorily provided specific references to the basis for determining acceptable system and component performance. In general, the revised test abstracts provide less detail than did their predecessors. A detailed review of the SSAR will be conducted to determine whether the test abstracts accurately reflect appropriate test conditions. Therefore, DSER Open Item 14.2.8-15 remained open.

In its December 6, 1996, response, Westinghouse stated its belief that specific references have been provided in each preoperational test abstract. These references specify the SSAR section which define the functions performed by each system which are to be tested in the Initial Test Program.

Based on the staff's review of Revision 11 to the SSAR, Chapter 14, this issue has been superseded by OITS 2559/RAI 260.51. Therefore, OITS 1253/DSER Open Item 14.2.8-15 is closed.

- OITS 1254/DSER Open Item 14.2.8-16: Closure of this issue is contingent upon the satisfactory resolution of OITS 1255/DSER Open Item 14.2.8.3-1, below (Action W).
- OITS 1255/DSER Open Item 14.2.8.3-1: In the DSER, the staff found that the preoperational and startup test phase descriptions in Section 14.2.8 of the SSAR did not provide assurance that the operability of several of the systems and components listed in Appendix A of RG 1.68 (Rev. 2, August 1978) will be demonstrated. The test abstracts of Section 14.2.8 of the SSAR should be expanded to address the following items identified in Appendix A to RG 1.68, or Appendix 1A of the SSAR should be revised to provide technical justification for any exceptions taken.

- Preoperational Testing

- 1.a.(2)(i) pressurizer safety valves
- 1.b.(1) control rod withdrawal inhibit and rod runback functions
- 1.c diverse actuation system, which protects the facility from anticipated transients without a scram (ATWS)
- 1.e.(4) steam generator pressure safety valves
- 1.e.(10) feedwater heaters and drains

- 1.f.(2) cooling towers and associated auxiliaries
- 1.j.(7) leak detection systems used to detect failures in the emergency core cooling system (ECCS) and containment recirculation systems located outside containment (for example, potential leakage in the normal residual heat removal (RHR) system or the post-accident sampling systems that could be used to recirculate reactor coolant outside containment after an accident)
- 1.j.(8) automatic reactor power control system and primary T-average control system
- 1.j.(13) excore neutron instrumentation
- 1.j.(17) feedwater heater temperature, level, and bypass controls
- 1.j.(20) instrumentation used to detect external and internal flooding conditions
- 1.j.(22) instrumentation used to track the course of postulated accidents such as containment wide-range pressure indicators, reactor vessel water level monitors, containment sump level monitors, high radiation detectors, and humidity monitors
- 1.j.(23) post-accident hydrogen monitors
- 1.j.(24) annunciators for reactor control and engineered safety features
- 1.k.(2) personnel monitors and radiation survey instruments (As the calibration program applied to these devices will be site-specific, it would be appropriate to identify this as a COL action item.)
- 1.k.(3) laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations
- 1.l.(5) isolation features for condenser offgas systems
- 1.m.(4) static load testing at 125 percent rated load of cranes, hoists, and associated lifting and rigging equipment
- 1.n.(5) secondary sampling systems
- 1.n.(9) drain systems and pumping systems serving essential areas

- 1.n.(12) boron recovery system
- 1.n.(13) communications systems relating to offsite emergency notification
- 1.n.(14)(c) class 1E electrical room heating, ventilating, and air conditioning
- 1.n.(14)(f) main control room (including proper operation of smoke and toxic chemical detection systems and ventilation shutdown devices, including leak tightness of ducts).
- 1.n.(15) shield cooling systems
- 1.o.(1) dynamic and static load tests of reactor components handling system cranes, hoists, and associated lifting and rigging equipment
- 1.o.(2) protective devices and interlocks of reactor components handling system equipment
- 1.o.(3) safety devices for reactor components handling systems equipment
- Initial Fuel Loading and Precritical Tests
 - 2.f reactor core and other major components differential pressure and vibration testing after fuel loading
- Low Power Testing
 - 4.i control rod block and inhibit functions
- Power Ascension Tests
 - 5.m reactor core and major reactor coolant system components differential pressure
 - 5.r process computer and control room computer
 - 5.t pressurizer safety valves and secondary system safety valves
 - 5.c.c gaseous and liquid radioactive waste processing, storage, and release systems (operating in accordance with design)
 - 5.g.g design features to prevent or mitigate anticipated transients without scram (ATWS)

5.k.k dynamic response of the plant for loss of feedwater heaters or bypassing feedwater heaters

These issues were previously identified by the staff in Q260.30 and were subsequently identified in the DSER as Open Item 14.2.8.3-1.

In its August 13, 1996, response to the staff, Westinghouse stated that "Subsection 14.2.9 has been revised to include test abstracts for appropriate AP600 systems and components as specified in RG 1.68, Revision 2, Appendix A."

In its November 8, 1996, response to Westinghouse, the staff found that Westinghouse had not satisfactorily revised test abstracts to demonstrate the requested items. A detailed review of the SSAR will be conducted to determine whether the test abstracts accurately reflect suitable test methods under the appropriate plant conditions. Therefore, DSER Open Item 14.2.8.3-1 remained open.

Nonetheless, the following items were provided to Westinghouse as initial comments derived from a limited review of these items.

- Appendix A to RG 1.68, Section (d) identifies steam line atmospheric dump valves and relief valves to be included in the preoperational testing. In Attachment 3 to the letter of July 16, 1996, Westinghouse listed these valves to be included in SSAR Chapter 14 Sections 14.2.9.2.1 and 14.2.9.1.2 respectively. However, the staff could not find the testing of these valves in the above two SSAR sections. Westinghouse is requested to add these valves according to Attachment 3.
- Appendix A to RG 1.68, Section (e) identifies steam generator pressure relief valves, turbine control and intercept valves, and main condenser hotwell level control system to be included in the preoperational testing. In Attachment 3 to the letter of July 16, 1996, Westinghouse listed these items to be included in SSAR Chapter 14 Sections 14.2.9.1.2, 14.2.9.2.1, or 14.2.9.4.1. However, the staff could not find the testing of SG pressure relief valves, turbine control and intercept valves in the above SSAR sections. Westinghouse is requested to add these items according to Attachment 3.
- Appendix A to RG 1.68, Section (f) identifies cooling towers and associated auxiliaries, and raw water and service water cooling towers to be included in the preoperational testing. In Attachment 3 to the letter of July 16, 1996, Westinghouse listed these items to be included in SSAR Chapter 14 Section 14.2.9.4.6. However, the staff could not find the testing of cooling towers and associated auxiliaries, and raw water and service water cooling towers in the above SSAR section. Westinghouse is requested to add these items according to Attachment 3.

In its December 6, 1996 response, Westinghouse stated the following:

"Section 14.2.9.1.2 Item a) commits to tests of safety-related valves in the SGS which includes the SG Power-Operated Relief (atmospheric dump) Valves. This section will be revised to delineate these valves specifically under item a).

Section 14.2.9.2.1 lists the other valves mentioned (with the appropriate AP600-specific name).

Test 14.2.9.4.6 does not specifically mention cooling towers for the following reasons:

- the circulating water system cooling tower is not within the scope of the AP600 design certification
- heat removal of an ultimate heat sink (such as a cooling tower) can not be tested during preops due to the absence of core power - commitments are made in 14.2.9.4.6 to test the ultimate heat sink (cooling tower or other) during hot functionals as appropriate

The service water cooling towers are tested as specified in 14.2.9.2.6."

The staff finds Revision 11 to the AP600 SSAR still does not address all issues identified under this open item. Specifically, the test abstracts of Sections 14.2.9 and 14.2.10 should be expanded to address the following items identified in Appendix A to RG 1.68, or Section 1.9 of the SSAR should be revised to provide technical justification for any exceptions taken.

1. Preoperational Testing

- 1.j.(7) Leak detection systems used to detect failures in normal RHR system, the post accident sampling system, or other systems that could be used to recirculate reactor coolant outside containment

2. Initial Fuel Loading and Precritical Tests

- 2.b Testing of control rod withdrawal and insert speeds
- 2.c Final functional testing of the reactor protection system
- 2.d Final test of the RCS to verify that system leak rates are acceptable
- 2.e Measurements of water quality.

4. Low Power Testing

- 4.e Determination of flux distribution to verify proper core loading and fuel enrichments
- 4.i Control rod block and inhibit functions
- 4.l Operability and response time tests of main steam isolation valves and their bypass valves at rated temperature and pressure conditions
- 4.r Operability of RCS purification and cleanup systems
- 4.u Operability of pressurizer pressure and level control systems

5. Power Ascension Tests

- 5.l Design capability of residual or decay heat removal systems including turbine bypass valves, atmospheric dump valves, normal residual heat removal, and feedwater systems, including demonstration that excessive flow instabilities will not occur
- 5.o Operability of RCS leak detection systems
- 5.r Process computer and control room computer.
- 5.s Operability of pressurizer pressure and level control systems
- 5.u Operability and response time tests of main steam isolation valves and their bypass valves
- 5.c.c Demonstrate that gaseous and liquid radioactive waste processing, storage, and release systems operate in accordance with design
- 5.k.k Dynamic response of the plant for loss of feedwater heaters or bypassing feedwater heaters

Therefore, OITS 1255/DSER Open Item 14.2.8.3-1 remains open.

- OITS 1256/DSER Open Item 14.2.8.4-1: In the DSER, the staff found that the preoperational and startup test phase descriptions in Section 14.2.8 of the SSAR did not provide assurance that the operability of several of the systems and components listed in the following RGs would be demonstrated. The test abstracts of Section 14.2.8 of the SSAR should be

expanded to address the following items, or Appendix 1A of the SSAR should be revised to provide technical justification for any exceptions taken.

- RG 1.68.2, "Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants" - Preoperational test abstract 14.2.8.1.94, "Remote Shutdown," does not provide sufficient detail to verify conformance with the following RP of RG 1.68.2:
 - Hot Standby Demonstration (RP C.3), including the following:
 - With initial conditions of the reactor at a moderate power level (10 to 25 percent), demonstrate that plant systems are in the normal configuration with the turbine generator in operation and with the minimum shift crew
 - Using only credited remote shutdown equipment, demonstrate the capability to achieve hot standby status, and maintain stable hot standby conditions for at least 30 minutes.
 - Cold Shutdown Demonstration (RP C.4), including the following:
 - with the plant at hot standby conditions;
 - with the procedurally designated crew positions;
 - using only credited remote shutdown equipment, demonstrate the capability to perform a partial cooldown by performing the following actions:
 - lower reactor coolant pressure and temperature sufficiently to permit operation of the residual heat removal (RHR) system
 - initiate and control operation of the RHR system
 - establish a heat transfer path to the ultimate heat sink
 - reduce reactor coolant temperature approximately 50 F using the RHR system
- RG 1.68.3, "Preoperational Testing of Instrument and Control Air Systems" - Preoperational test abstract 14.2.8.1.6, "Compressed and Instrument Air Systems," does not provide sufficient detail to verify conformance with the following RPs of RG 1.68.3:

- After coolers, oil separators, air receivers, and pressure-reducing stations (RP C.2)
 - Flow, temperature, and pressure meet design specifications (RP C.4)
 - Total air demand with leakage meets design (RP C.5)
 - Single failure criterion (RP C.7)
 - Sudden and gradual loss of system pressure and appropriate response of air power equipment (RP C.8)
 - Functional test for increase in the air supply system pressure does not cause loss of operability (RP C.11)
- RG 1.140 - Preoperational test abstracts 14.2.8.1.28, "Containment Air Filtration System," 14.2.8.1.29, "Radiologically Controlled Area Ventilation Test," and 14.2.8.1.88, "High-Efficiency Particulate Air Filters and Charcoal Absorbers" do not provide sufficient detail to verify conformance with the following RP of RG 1.140.
 - heaters (RP C.3.a)
 - prefilters (RP C.3.m)
 - HEPA filters DOP tests (RPs C.3.b and C.5.c)
 - ductwork (RP C.3.f)
 - fans and motors mounting and ductwork (RP C.3.i)
 - dampers (RP C.3.l)
 - adsorber sections/cells and activated charcoal (RPs C.3.h and C.5.d)

These issues were previously identified by the staff in Q260.31. This was identified in the DSER as Open Item 14.2.8.4-1.

In its August 13, 1996, response to the NRC, Westinghouse stated the following:

"Subsection 14.2.9.1.12 has been revised to include testing to verify the ability to initiate actuation signals to the systems/components required for reactor shutdown from the remote shutdown workstation. Note that the AP600 remote shutdown workstation provides the operator with the same capability to maintain the plant at hot shutdown conditions, or to cool the plant down; as is provided from the main control room. Therefore, the operator does not need to perform manual actions

or operate equipment from local control panels. In addition, test abstracts for the instrument and compressed air system and appropriate HVAC systems have been revised.

In its November 8, 1996, response to Westinghouse, the staff concluded that Westinghouse had not satisfactorily revised test abstracts to demonstrate the requested items. In general, the revised test abstracts provide less detail than did their predecessors. A detailed review of the SSAR will be conducted to determine whether the test abstracts accurately reflect appropriate test conditions. Therefore, DSER Open Item 14.2.8.4-1 remained open.

In its December 6, 1996 response, Westinghouse stated the following:

"Westinghouse would appreciate specific comments from the staff on the appropriate test abstracts so that we can address the staff's concerns in these areas more readily.

For the instrument and control air systems, and the containment air filtration system, it should be noted that these are non-safety systems in the AP600 and therefore may not require as explicit details for testing these systems."

During its review of Revision 11 of the SSAR, the staff concluded that Westinghouse has satisfactorily address the staff's concerns related to RG 1.140. However, the following issues remain with respect to RG 1.68.2 and RG 1.68.3:

RG 1.68.2

Section 1.9, Appendix 1A, states that exception has been taken regarding testing of the AP600 remote shutdown workstation in accordance with RG 1.68.2. The basis for this exception is the similarity of the remote shutdown station (RSS) to the main control room workstations, the testing of plant control capability from the main control room, and the testing of the RSS controls and indications during pre-operational testing.

The RSS testing in the ITP is described in Sections 14.2.9.1.12 and 14.2.9.2.12. Section 14.2.9.1.12, "Protection and Safety Monitoring System Testing," tests, in part, manual reactor trip capability from the RSS, and also tests the processing of manual actuation commands from the RSS to the protection logic cabinets through simulated command inputs to the logic cabinets and simulated logic cabinet outputs on component status to the RSS. Section 14.2.9.2.12, "Plant Control System Testing," provides testing of RSS control functions based on simulated inputs at the RSS and verification of proper output through contact operation, component actuation, or electrical test.

While similarity of the RSS workstations to those in the main control room, and successful testing of the main control room workstations and individual RSS process signals can provide a certain level of confidence with regard to proper RSS operation, they do not suffice as a replacement for integrated control system testing of the RSS. In addition, although the control room and RSS workstations may be similar, the working environment is different to the operator from that of the control room which is the normal workspace. The operators should demonstrate the ability to perform plant control in an abnormal work environment with the minimum set of controls and indications available under postulated control room evacuation scenarios. The Section 14 test abstracts should therefore be modified to demonstrate the remote shutdown capability of the plant in accordance with RG 1.68.2.

RG 1.68.3

During the March 21, 1995, meeting, Westinghouse committed to resolving RAI 410.161 (Item No. 244) by including pre-operational testing as described in RG 1.68.3, "Preoperational Testing of Instrument and Control Air Systems" in Section 14.2.9.4.10, "Compressed and Instrument Air System Testing." Specifically, the following information still needs to be added to the test abstract.

- a. All safety-related pneumatically operated valves should be verified to fail in the position specified in SSAR Table 9.3.1-1 upon a complete and sudden loss of instrument air pressure and a gradual loss of instrument air pressure.
- b. The instrument air system should be functionally tested to ensure credible failures resulting in an increase in instrument air system pressure will not cause loss of operability.
- c. The instrument air system air quality should be tested to meet ANSI/ISA S7.3, "Quality Standard for Instrument Air."
- d. While at instrument air system normal steady state conditions, if practical, simultaneously operate those plant components requiring large quantities of instrument air for operation, to verify pressure transients in the distribution system do not exceed acceptable values.
- e. Verify that the total air demand at normal steady state conditions, including leakage from the systems, is in accordance with design.
- f. Additionally, the test abstract should include the following statements:
 - "Demonstrate the operability of the air compressor dryers and filters, intercoolers, aftercoolers, moisture separators, and air receivers."

- "Verify appropriate differential pressures (e.g., delta P across prefilters and afterfilters)."
- "Verify relief valve settings."

Therefore, OITS 1256/DSER Open Item 14.2.8.4-1 remains open.

- OITS 1257/DSER Open Item 14.2.9-1: In the DSER, the staff recommended that Section 14.2.9 of the SSAR be retitled as "COL License Information - Initial Test Program." This title would more accurately reflect the purpose of this section within the SSAR (i.e., to identify the information to be supplied to the NRC by COL applicants referencing the AP600 design). In addition, the content of Section 14.2.9 of the SSAR should be revised to include "site-specific aspects of the plant," such as the following systems that may require testing "to satisfy certain AP600 interface requirements":

- electrical switchyard equipment
- site security plan equipment
- personnel monitors and radiation survey instruments
- automatic dispatcher control system (if applicable)

This item corresponds to Q260.32 and was identified in the DSER as Open Item 14.2.9-1.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.3 provides reference to COL information items to verify site specific aspects of the plant that may require testing are within the certification envelope."

In its November 8, 1996, response to Westinghouse the staff clarified that in its July 22, 1994, letter to the NRC, and in response to Q260.32, Westinghouse had agreed to the staff's proposed revisions and recommendations. However, Revision 9 to the SSAR has relocated such information to Section 14.3, "Certified Design Material." In its August 13, 1994, response to this open item, Westinghouse stated that Section 14.3 "provides reference to COL information items to verify site specific aspects of the plant that may require testing are within the [design] certification envelope."

Based on the above, the staff requested that Westinghouse identify which subsection of Section 14.3, "Certified Design Material," designates "site-specific aspects of the plant" that may require testing by the COL applicant to satisfy certain AP600 interface requirements, such as those identified in Q260.32. DSER Open Item 14.2.9-1 remained open.

In its December 6, 1996 response, Westinghouse stated the following:

"Interface requirements as defined by 10 CFR Part 52.47 (a)(1)(vii) are discussed in Section 14.3, fourth bullet. It is not necessary to provide a list of possible systems that may or may not require testing, as this determination will be made by the NRC at the time of the COL application."

The staff disagrees with Westinghouse's interpretation of §52.47(a)(1)(vii). Westinghouse needs to specifically identify the structures and systems that are wholly or partially outside the design scope and specify the interface requirements for those systems, including testing to be performed by the COL applicant. Westinghouse should address this issue in conjunction with Q640.52. OITS 1257/DSER Open Item 14.2.9-1 remains open.

- OITS 1258/DSER Open Item 14.2.9-2: In the DSER, the staff found that the startup administrative manual, described in Section 14.2.2.1 of the SSAR, should be identified in this section [14.2.2.1 Conduct of Test Program], and in others as appropriate, as "COL License Information" (i.e., information to be supplied to the NRC by COL applicants referencing the AP600 design). In addition, Westinghouse should include a description of the organizational units and any augmented organizations or other personnel that will manage, supervise, or execute any phase of the ITP in a manner consistent with the guidance in Section 14.2.2 of RG 1.70. Portions of the issues outlined above were previously identified by the staff in Q260.25.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.4 has been revised to include a COL information item to provide a startup administrative manual that will delineate specific permissions required for the approval of test results and the permission to proceed to the next testing phase."

In its November 8, 1996, response to Westinghouse, the staff found that Section 14.4.3, "Conduct of Test Program," states that the COL applicant is responsible for [developing] a startup manual as identified in Subsection 14.2.3, "Test Procedures". The staff added that Westinghouse had apparently addressed the specific issues identified in Q260.25, and therefore, DSER Open Item 14.2.9-2 was considered closed pending completion of the Chapter 14 detail review (Confirmatory).

The staff has completed its review of Revision 11 to the SSAR, Chapter 14 with respect to Q260.25. Therefore, OITS 1258/DSER Open Item 14.2.9-2 is closed.

□ OITS 1791/DSER Confirmatory Item 3.9.2.1-3 (RAI 210.55):

In the DSER, the staff found that Westinghouse should revise Section 14.2.8.2.18 (start-up thermal expansion testing) to reflect the response to RAI 210.55. Staff review determined that Revision 9 for SSAR Chapter 14 replaced Section 14.2.8.2.18 with Section 14.2.10.4.25, "Thermal Expansion," and that the response to RAI 210.55, which was the basis for DSER Confirmatory Item 3.9.2.1-3, does not appear in this new section. As committed to in the response to RAI 210.55, the test specifications for thermal expansion testing during preoperational and start-up testing are in accordance with ASME OM Standard, Part 7. This commitment is in Section 14.2.9.1.7 for preoperational testing. This same commitment should be added to Section 14.2.10.4.25 for startup testing. Therefore, OITS 1791/DSER Confirmatory Item 3.9.2.1-3 remains open.

□ OITS 1792/DSER Confirmatory Item 3.9.2.1-4 (RAI 210.57):

In the DSER, the staff found that Westinghouse should revise Section 14 test abstracts to reflect the response to RAI 210.57. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.7, "Expansion, Vibration and Dynamic Effects Testing," was revised to include reference to Section 3.9.2. Staff review determined that a reference to SSAR Section 3.9 is in the first paragraph of Section 14.2.9.1.7, however, as committed to in the response to RAI 210.57, a specific reference to Section 3.9.2.1.1 for the acceptance standard for alternating stress intensity due to vibration should be added to Sections 14.2.9.1.7(b) and 14.2.10.4.18. Therefore, OITS 1792/DSER Confirmatory Item 3.9.2.1-4 remains open.

□ OITS 1793/DSER Confirmatory Item 3.9.2.3-1 (PAI 210.58):

In the DSER, the staff found that Westinghouse should revise Section 14.2.8.1.77 (reactor internals and reactor coolant system vibration test) to reflect the response to RAI 210.58. Staff review determined that Section 14.2.8.1.77 was replaced by Section 14.2.9.1.9, "Reactor Vessel Internals Vibration Testing," in Revision 9 of Chapter 14. This new section only addresses the prototype plant (first plant only) tests to comply with that portion of RG 1.20. There should be another section in Chapter 14 to provide the same commitment as that in Section 3.9.2.4 for non-prototype plants. OITS 1793/DSER Confirmatory Item 3.9.2.3-1 remains open.

□ OITS 1828/DSER Confirmatory Item 14.2.7-1: In the DSER, the staff found that the SSAR needed to be revised to state that the startup administrative manual (procedures) will be the responsibility of the COL applicant, as will other documents that delineate the test program schedule for the initial test program.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.4, has been revised to include a COL information item to provide a startup administrative manual that will delineate the test program schedule for staff review."

In its November 8, 1996, response to Westinghouse, the staff concluded that closure of this issue is contingent upon the satisfactory resolution of OITS 1258/DSER Open Item 14.2.9-2, above. Therefore, OITS 1828/DSER Confirmatory Item 14.2.7-1 is closed.

- OITS 1963/DSER COL Open Item 14.2.2-1: In the DSER, the staff found that the COL applicant should provide for staff review, the scoping document (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to Westinghouse's scope of design responsibility.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.4, has been revised to include a COL item to provide preoperational and startup test procedures containing test objectives and acceptance criteria for Westinghouse scope systems/components."

In its November 8, 1996, response to Westinghouse, the staff concluded that closure of this issue is contingent upon the satisfactory resolution of OITS 1236/DSER Open Item 14.2.2-2, above. Therefore, OITS 1963/DSER COL Open Item 14.2.2-1 remains open.

- OITS 1964/DSER COL Open Item 14.2.2-2: In the DSER, the staff found that the COL applicant should provide for staff review, the scoping document, and any related documents, which delineate plant operational conditions at which tests are to be conducted, testing methodologies to be utilized, specific data to be collected, and acceptable data reduction techniques to be utilized.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.4, has been revised to include a COL item to provide preoperational and startup test procedures to delineate test conditions, testing method, data to be collected, and data reduction techniques."

In its November 8, 1996, response to Westinghouse the staff found that Section 14.4.3, "Conduct of Test Program," states that the COL applicant is responsible for [developing] a startup manual as identified in Subsection 14.2.3, "Test Procedures".

The staff added that Westinghouse had apparently addressed the specific issues identified in this open item, and therefore, DSER Open Item 14.2.2-2 was considered closed pending completion of the Chapter 14 detail review (Confirmatory).

The staff has completed its review of Revision 11 to the SSAR, Chapter 14, with respect to this COL item and found it satisfactory. Therefore, OITS 1964/DSER COL Open Item 14.2.2-2 is closed.

- OITS 1965/DSER COL Open Item 14.2.2-3: In the DSER, the staff found that the COL applicant should provide for staff review, the scoping document that delineates any reconciliation methods needed to account for test conditions, methods, or results if testing is performed at conditions other than representative of design operating conditions.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.4, has been revised to include a COL item to provide preoperational and startup test procedures to delineate any reconciliation methods needed to account for test conditions, methods, or results if testing is performed at conditions not representative of design conditions."

In its November 8, 1996, response to Westinghouse the staff requested that Westinghouse identify which subsection of Section 4.4, "Combined License Applicant Responsibilities," includes the COL applicant item identified in DSER Open Item 14.2.2-3 (See DSER Open Item 14.2.2-2, above).

In its December 6, 1996, response to the NRC, Westinghouse indicated that their response to OITS 1236/DSER Open Item 14.2.2-2 (above) also addressed this open item. The staff concurred that closure of this issue is contingent upon the satisfactory resolution of OITS 1236/DSER Open Item 14.2.2-2, above. Therefore, OITS 1965/DSER COL Open Item 14.2.2-3 remains open.

- OITS 1966/DSER COL Open Item 14.2.2-4: In the DSER, the staff found that the COL applicant should provide for staff review, the approved preoperational test procedures (to be provided approximately 60 days before their intended use), and startup test procedures (to be provided approximately 60 days before fuel loading).

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.4, has been revised to include a COL item to provide preoperational and startup test procedures for all safety-related systems, and systems that perform defense-in-depth functions approximately 60 days before their intended use; and to provide approved startup test procedures 60 days before fuel loading."

In its November 8, 1996, response to Westinghouse the staff concluded that while Section 14.2.3, "Test Procedures," as referenced in Section 14.4, appeared to address the COL item identified above, Subsection 14.2.3 appears to also draw an unacceptable distinction between the availability (for NRC review) of preoperational test procedures for systems/components that perform safety-related functions, or of those

that are nonsafety-related but perform defense-in-depth functions (in the context of the AP600 design) versus those that do not perform either type of functions but which still satisfy RG 1.68, RP C.1, "Criteria for Selection of Plant Features To Be Tested." RG 1.68 does not provide for this distinction and, therefore, all plant system and/or features identified in accordance with Subsection 14.2.1, "Summary of Test Program and Objectives," (once found acceptable) are subject to NRC review and approval. This exception to RG 1.68 is unacceptable and should be deleted.

Additionally, it is inappropriate for this subsection to specify that only safety-related initial test program testing will be conducted in accordance with the quality assurance requirements of SSAR Section 17.4. While RG 1.68 and Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50 both recognize that not all SSCs have to be tested to the same stringent requirements, they both also hold that the test program must be conducted in a manner that establishes that SSCs will perform satisfactorily in service. Westinghouse's statement in this subsection implies that all testing of SSCs that do not perform safety-related functions will be performed in accordance with quality assurance requirements not currently described in SSAR Section 17.4. Westinghouse should delete this statement or, otherwise, supplement SSAR Section 17.4 to include a detailed description of the quality assurance program requirements that will govern testing of SSCs that do not perform safety-related functions. DSER Open Item 14.2.2-4 remained open.

In its December 6, 1996, response to the NRC, Westinghouse stated the following:

"R.G. 1.68 provides for a 'graded approach' and that 'While it is required that all SSCs important to safety be tested, it is not required that all of them be tested to the same stringent requirements.' Westinghouse has provided a comprehensive and systematic process to identify SSC necessary to be included in the ITP to 'provide reasonable assurance that the facility (AP600) can be operated without undue risk to the public.' Based on a review of the AP600 SSCs, the SSCs requiring the highest level test commitments are the safety-related and defense-in-depth systems. The other systems included in the ITP have been provided for completeness, and need not and do not require the same level of test commitment with regards to the ITP.

To clarify the distinction between the most important and least important systems, Section 14.2.3 will be revised to state that: 1) Test specifications and test procedures for SSCs which perform in safety related or defense in depth functions will be available for NRC review prior to performance of the test, and 2) All testing will be performed in accordance with the quality assurance requirements as specified in Section 17.4.

Additionally, Section 17.4 will be revised to include testing within the Quality Assurance program developed by the combined license applicant. (Proposed SSAR Revision: Pages 14.2-5 and 17.1-2)." The staff found Westinghouse's justifications on this issue partially responsive to the staff's concerns identified in DSER COL Open Item 14.2.2-4. However, a final determination on this issue would not be made until (1) the staff finds the revised Section 17.4 of the AP600 SSAR acceptable, and (2) the staff completes its comprehensive review of Chapter 14.

The staff has completed its review of Revision 11 to the SSAR, Chapters 14 and 17 with respect to this COL item. Therefore, OITS 1966/DSER COL Open Item 14.2.2-4 is closed.

- OITS 1967/DSER COL Open Item 14.2.2.2-1: In the DSER, the staff found that the COL applicant should provide the startup administrative manual, which will delineate the review, evaluation, and approval of test results, for staff review.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.4, has been revised to include a COL item to provide the startup administration manual which delineates the review, evaluation, and approval of test results."

In its November 8, 1996, response to Westinghouse the staff requested that Westinghouse identify which subsection of Section 14.4, "Combined License Applicant Responsibilities," includes the COL applicant item identified in DSER Open Item 14.2.2-1.

In its December 6, 1996, response to the NRC, Westinghouse stated that "Section 14.4.3 Conduct of Test Program" includes the COL applicant item identified in DSER Open Item 14.2.2-1, and closure of OITS 1967/DSER COL Open Item 14.2.2.2-1 was contingent upon the staff's acceptability of the contents of Section 14.4.3, "Conduct of Test Program".

The staff has completed its review of Revision 11 to the SSAR, Chapter 14, with respect to this COL item and found it satisfactory. Therefore, OITS 1967/DSER COL Open Item 14.2.2.2-1 is closed.

- OITS 1968/DSER COL Open Item 14.2.8-1: Issues identified under this open item correlate with those identified in OITS 1245/DSER Open Item 14.2.8-7, above.

In its August 13, 1996, response to the NRC, Westinghouse stated that "Section 14.3 references Certified Design Material which commits the COL to conduct an Initial Test Program. As part of that Initial Test program, the COL will verify that reactor coolant system parameters are comparable to the first AP600 plant in order to obtain similar natural circulation flows."

In its November 8, 1996, response to Westinghouse the staff concluded that closure of this COL open item was contingent upon the satisfactory resolution of OITS 1245/DSER Open Item 14.2.8-7, above, and therefore, DSER COL Open Item 14.2.8-1 remained open.

In its December 6, 1996, response to the NRC, Westinghouse referred to its response to OITS 1245/DSER Open Item 14.2.8-7, above, as providing the bases for closure of this open item. However, this issue has been superseded by OITS 1245/DSER Open Item 14.2.8-7. Therefore, OITS 1968/DSER COL Open Item 14.2.8-1 is closed.

- OITS 2543/RAI 260.35: In RAI 260.35, the staff requested that reactor coolant system testing be modified to clearly indicate that if there is any evidence of leakage within the hydrostatic test boundaries, that the leak is to be repaired and retested prior to final inspection. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.1, "Reactor Coolant System Testing," has been revised to indicate that if there is any evidence of leakage, that the leak is to be repaired and retested prior to final inspection. Staff review of Section 14.2.9.1.1, "Reactor Coolant System Testing," indicates that it has not been modified as stated. The wording of this section still allows a leak to be isolated, repaired and retested at a later date. This section should be modified to remove the allowance for retesting at a later date. OITS 2543/RAI 260.35 remains open.
- OITS 2552/RAI 260.44: In RAI 260.44, the staff requested that various reactor coolant system flow measurements be verified, including baseline RCS pressure drops. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.1, "Reactor Coolant System Testing," has been revised to include appropriate flow measurement testing. Staff review of this section determined that baseline RCS pressure drop testing is not specified. Section 14.2.9.1.1, "Reactor Coolant System Testing," should be revised to include the establishment of, and appropriate acceptance criteria for, baseline RCS pressure drops. OITS 2552/RAI 260.44 remains open.
- OITS 2558/RAI 260.50: In RAI 260.50, the staff requested that, among other items, the initial fuel loading test sequence should outline all systems required for the initial fuel loading. Westinghouse responded in their August 13, 1996, letter that Sections 14.2.10.1.1 and 14.2.10.1.5 had been modified accordingly. Staff review of these sections determined that the revision did not completely address the noted issues. The prerequisites of either Section 14.2.10.1.1, "Fuel Loading Prerequisites and Periodic Checks," or Section 14.2.10.1.5, "Initial Fuel Loading," should be modified to outline all systems required for initial fuel loading, and should additionally address criteria or prerequisites for minimum count rate, instrumentation signal to noise ratios, criticality predictions, and any special procedural

actions. Rod withdrawal sequences should also be specified to be the same as for a normal startup. (RG 1.68, App. A, Section 3). OITS 2558/RAI 260.50 remains open.

- OITS 2559/RAI 260.51: In RAI 260.51, the staff requested that certain test abstracts be revised to provide specific acceptance criteria or design basis functional requirements traceable to the appropriate SSAR sections. Westinghouse responded in their August 13, 1996, letter that the noted test abstracts have been revised. Staff review of the revised Chapter 14 submittal determined that a number of additional sections require more detailed acceptance criteria. The following sections should be revised to provide or reference specific acceptance criteria or design basis functional requirements traceable to specific subsections or numbered paragraphs of the SSAR, the plant Technical Specifications, or other appropriate references that contain the detailed structure, system, or component design/performance criteria that is being verified by the testing:

14.2.10.1.7	14.2.10.1.19	14.2.10.4.3
14.2.10.1.8	14.2.10.1.20	14.2.10.4.5
14.2.10.1.9	14.2.10.2.3	14.2.10.4.7
14.2.10.1.10	14.2.10.2.4	14.2.10.4.10
14.2.10.1.11	14.2.10.3.2	14.2.10.4.13
14.2.10.1.12	14.2.10.3.3	14.2.10.4.15
14.2.10.1.15	14.2.10.3.5	14.2.10.4.20
14.2.10.1.16	14.2.10.3.6	

Therefore, OITS 2559/RAI 260.51 remains open.

- OITS 2563/RAI 260.55 In RAI 260.55, the staff requested that the post-fuel loading precritical test sequence was inadequate in that revision was required of the prerequisites, test method, and acceptance criteria subsections. Westinghouse responded in their August 13, 1996, letter that Section 14.2.10.1.6, "Post-Fuel Loading Precritical Test Sequence," has been revised to specify plant system conditions and acceptance criteria as contained in subsequent precritical testing. Staff review of this section determined that it does not provide any additional information than is already provided in other existing test abstracts. If the intent of this section is to provide a test sequence or to outline all systems required for initial criticality, it should be modified accordingly. OITS 2563/RAI 260.55 remains open.
- OITS 2567/RAI 260.59: In RAI 260.59, the staff requested that the load swing test be revised to address a number of specific concerns including providing acceptable ranges of key plant parameters. Westinghouse responded in their August 13, 1996, letter that Section 14.2.10.4.20, "Load Swing Test," acceptance criteria has been expanded to include a review of plant response and adjustment of control systems, if necessary. Staff review of this section determined that it has not been

expanded from the earlier submittal. The performance criterion subsection should be modified to specify or reference the acceptable ranges of the evaluated parameters. OITS 2567/RAI 260.59 remains open.

- OITS 2547/Q260.39: ITP Test Abstract 14.2.8.1.30, Feedwater Control System: The Test Method subsection should be revised to incorporate verification that automatically initiated valve open/closure cycling and timing meets the system design basis requirements.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the steam generator system in Subsection 14.2.9.1.2, specifies that the proper operation of the main and startup feedwater valves is verified, including automatic open/close valve operation and timing. Additional testing of the main feedwater valves is specified with the reactor at power during the startup testing described in Subsection 14.2.10.1.22."

In its November 8, 1996, response to Westinghouse the staff concluded that Subsection 14.2.9.1.2 does not specify that the proper operation of main and startup feedwater valves is verified as noted. Therefore, OITS 2547/Q260.39 remained open.

In its December 6, 1996, response to the NRC, Westinghouse stated the following:

"Section 14.2.9.1.2 bullet (a) verifies proper operation of safety-related valve functions and includes the main feedwater SG isolation valves.

Section 14.2.9.2.2 bullet(a) tests the defense-in-depth valve functions associated with the FWS to verify their proper operation. This section is revised to include verification of the proper functioning of the main feedwater pump and control valves."

While the staff agrees with Westinghouse with regards to the content of Subsections 14.2.9.1.2 and 14.2.9.2.2, during its review of Revision 11 of the SSAR, Chapter 14, the staff found that Subsection 14.2.10.1.20, "Feedwater Valve Stroke Test," should be modified to provide an acceptable reference to system design basis requirements for allowable closure and cycling times. Therefore, OITS 2547/Q260.39 remains open.

- OITS 2568/Q260.60: In ITP Test Abstract 14.2.8.2.50, "50 Percent Load Rejection," the Performance Criterion subsection should specify the acceptable ranges of the primary and secondary parameters (pressure, level, temperature, etc.) or provide specific acceptance criteria or design basis functional requirements traceable to the appropriate SSAR sections.

- Annex/Auxiliary Building Non-Radioactive HVAC System, conforming to the functions of the system as described in SSAR Section 9.4.2, and RG 1.68, Appendix A, Items 1.n.14.a, 1.n.14.c, 1.n.14.e and 1.h.6.
- Radwaste Building Ventilation System, conforming to the functions of the system as described in SSAR Section 9.4.8, and RG 1.68, Appendix A, Items 1.n.14.a and 1.n.14.e.
- Turbine Building Ventilation System, conforming to the functions of the system as described in SSAR Section 9.4.9, and RG 1.68, Appendix A, Items 1.n.14.a and 1.n.14.e.
- Diesel generator Ventilation System, conforming to the functions of the system as described in SSAR Section 9.4.10, and RG 1.68, Appendix A, Items 1.n.14.a and 1.n.14.d.
- Health Physics and Hot Machine Shop HVAC System, conforming to the functions of the system as described in SSAR Section 9.4.10, and RG 1.68, Appendix A, Items 1.n.14.a and 1.n.14.e.

In its December 6, 1996, response to the NRC, Westinghouse stated the following:

- " The following test abstracts will be added to Chapter 14 and are attached for your review:
- The Annex/Auxiliary Building non-radioactive HVAC System
 - Turbine Building Ventilation System
 - Health Physics and Hot Machine Shop HVAC System
 - Radwaste Building Ventilation System

Testing of the Diesel Generator Ventilation System is specified as part of the testing for the diesel generators in the current Chapter 14.2.9.2.17."

During its review of Revision 11 of the SSAR, the staff concluded that Westinghouse has satisfactorily address the staff's concerns related to Q260.62. Any inadequacies with respect to testing of AP600 plant-specific design features, identified above, found by the staff during its continuing review of Chapter 14 will be identified and tracked separately. Therefore, OITS 2570/Q260.62 is closed.

- OITS 2571/RAI 260.63: In RAI 260.63, the staff requested that preoperational testing should be provided for the 480V non-Class 1E transportable ac generator and its distribution panel. Westinghouse responded in their August 13, 1996, letter that Section 14.2.9.1.16, "Long-Term Safety-Related System Support Testing," has been revised to include verification of the proper operation of the generator. Staff review determined that this section only tests the ability to power

post-accident monitoring instrumentation from the portable generator. Table 8.3.1-4 of the SSAR lists several other design loads, including certain fixed and portable HVAC systems, and Control Room/Remote Shutdown Station lighting, that are additionally (potentially) powered from the portable generator. The portable units should be tested to ensure that they can supply design load to these various systems. OITS 2471/RAI 260.63 remains open.

- OITS 2641/Q260.67: Chapter 14 - Initial Test Program. 14.2.8.1.18, In-Plant Communication System: The Test Methods and Performance Criterion subsections of this abstract need to be revised to demonstrate acceptable performance of all subsystems encompassed by the In-Plant Communication System as described in SSAR Section 9.5.2.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the plant communication system in Subsection 14.2.9.4.13 has been revised to include verification of the proper performance of the system subsystems."

In its November 8, 1996 response to Westinghouse, the staff found that SSAR Section 9.5.2 states that the In-plant Communication system includes the following subsystems:

- Wireless telephone system
- Telephone/page system
- Private automatic branch exchange (PABX) system
- Sound power phone system
- Emergency response facility communication system
- Security communication system

The communication system allows each guard, watchman or armed response individual on duty, to maintain continuous communication with an individual at each manned alarm station (access to vital areas) and with off-site agencies as required by 10 CFR 73, Section 55 (e) Detection Aids, and (f) Communication Requirements. Communication equipment used with respiratory protection devices will be designed and selected in accordance with EPRI guidance document NP-6659, "Voice Communication Systems Compatible with Respiratory Protection."

The "General Test Methods and Acceptance Criteria" should include a procedure to verify the above commitments. Therefore, OITS 2641/Q260.67 remained open.

In its December 6, 1996, response to the NRC, Westinghouse stated that "These subsystems will be added to Subsection 14.2.9.4.13."

The staff has reviewed Revision 11 to the SSAR, Chapter 14, and found that Subsection 14.2.9.4.13 now includes the subsystems identified in SSAR Subsection 9.5.2. However, Westinghouse did not include a commitment to EPRI guidance document NP-6659 as requested by the staff.

Therefore, this portion of OITS 2641/Q260.67 remains open.

- OITS 2642/Q260.68: Chapter 14 - Initial Test Program. 14.2.8.1.51, Operations and Control Center System: This test abstract does not reflect the design and configuration of the AP600 Operations and Control Center System. Specifically, the primary plant control system operator interface is a set of "soft" control units that replace conventional switch/light or potentiometer/meter assemblies used for operator interface with control systems. The function-based test analysis serves as the basis for determining the alarms, displays, controls, and procedures in the main control area.

The Test Methods and Performance Criterion subsections of this abstract need to be revised to demonstrate acceptable performance of, and to encompass, these unique AP600 design features.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the plant control system in Subsection 14.2.9.2.12 has been revised to reflect the use of "soft" controls and function-based analysis for alarms, displays, controls, and procedures used in the AP600."

In its November 8, 1996, response to Westinghouse, the staff found that the general test methods and acceptance criteria should include the use of "soft" controls and function-based analysis for alarms, displays, controls, and procedures used in the AP600. Therefore, OITS 2642/Q260.68 remained open.

In its December 6, 1996, response to the NRC, Westinghouse requested that the staff "provide more specific information regarding the comment to include use of 'soft' controls in this test abstract. While the term "soft" is not used in this abstract, the test methods do include the use of "soft" controls during testing of the plant control system hardware and software." The staff is continuing to evaluate Revision 11 of the SSAR, Chapter 14, and Westinghouse's response to this item. (Action N).

- OITS 2646/Q260.72: Chapter 14 - Initial Test Program. 14.2.8.1.81, Pressurizer Pressure and Level Control: The Test Method subsection does not include testing of signal selector and isolation devices. Westinghouse should revise this subsection to encompass testing of these devices or should identify the test abstract that encompasses such testing.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the reactor coolant system in Subsection 14.2.9.1.1 specifies that the proper operation of the pressurizer pressure and level control is verified. Additional testing is also performed during the startup testing. Detailed methods for performing

this verification, including signal selector and isolation devices, are to be included in the actual test procedures developed by the COL applicant."

In its November 8, 1996, response to Westinghouse, the staff found that the RAI's concern on testing of signal selector and isolation devices was not addressed in Subsection 14.2.9.1.1 or any other startup testing sections. The staff requested that Westinghouse either specify how the COL applicant can develop test procedures to cover those components, or modify the appropriate test abstracts to reflect these tests. Therefore, OITS 2646 remained open.

In its December 6, 1996, response to the NRC, Westinghouse stated that "Consolidated system level tests encompass multiple functions provided by integrated system assemblies. It is the intent that subsections (a) and (d) of Subsections 14.2.9.2.12, 'Plant Control System. . .' include testing of the signal selector, distributed controllers, process bus multiplexers, etc. as related to Pressurizer Pressure and Level Control as well as other significant PLS functions." The staff is continuing to evaluate Revision 11 of the SSAR, Chapter 14, and Westinghouse's response to this item. (Action N).

- OITS 2648/Q260.74: Chapter 14 - Initial Test Program, 14.2.8.2.46, Plant Control System: The scope of this test should be expanded to encompass all other Plant Control System subsystems as identified in SSAR Chapter 7.1. Alternatively, Westinghouse should identify the test abstracts that currently encompass such subsystems.

In its August 13, 1996, response to the NRC, Westinghouse stated that "The test abstract for the plant control system in Subsection 14.2.9.2.12 has been revised to include the control functions specified in SSAR Section 7.1"

In its November 8, 1996, response to Westinghouse, the staff found that Section 14.2.9.2.12 had not addressed all the control functions specified in the SSAR. Therefore, OITS 2648/Q260.72 remained open.

In its December 6, 1996, response to the NRC, Westinghouse stated that "The plant control systems functions to be tested are delineated in the two bullets under the Subsection 14.2.9.2.12 labeled 'Purpose' and coincide with the functions listed in SSAR Section 7.1.3, first paragraph. While each function is not specifically mentioned in the General Test Methods and Acceptance Criteria of Subsection 14.2.9.2.12, the general test methods of paragraphs a), b), c), and d) apply to each function described above." The staff is continuing to evaluate Revision 11 of the SSAR, Chapter 14, and Westinghouse's response to this item. (Action N).

- ▣ OITS 2931/Q260.75: This issue has been superseded by NSD-NRC-96-4772, dated July 16, 1996. This item is closed.
- ▣ OITS 2932/Q260.76: This issue has been superseded by NSD-NRC-96-4772, dated July 16, 1996. This item is closed.

**AP600 CHAPTER 14, INITIAL TEST PROGRAM
NEW REQUESTS FOR ADDITIONAL INFORMATION**

- 260.91 Westinghouse should demonstrate conformance with its commitment to Regulatory Guide (RG) 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition), Revision 3 11/78 by providing the following:
- a) As described in Subsections 14.2.3, "Test Procedures" and 14.2.4, "Conduct of Test Programs" of RG 1.70, SSAR Section 14.2.3, "Test Specifications and Test Procedures," or alternatively, Section 14.2.3.1, "Conduct of Test Program," should be revised to include a description of how organizations responsible for the design of the facility will participate in the establishment of performance requirements and acceptance criteria for testing plant structures, systems, and components and how such design organizations will interface with other participants involved in the test program. This description should also include the methods to be followed in initiating design modifications or maintenance activities that are determined to be required by the test program, including methods that will be used to ensure retesting following such modifications or maintenance activities and the involvement of the design organization and the Combined License (COL) applicant in the review and approval of proposed plant modifications.
 - b) As described in Subsection 14.2.5, "Review, Evaluation, and Approval of Test Results" of RG 1.70, SSAR Section 14.2.3.2, "Review of Test Results," should be revised to include a description of the measures to be established for the review, evaluation, and approval of test results for each major phase of the program. The specific controls to be established to ensure notification of affected and responsible organizations or personnel when test acceptance criteria are not met and the controls established to resolve such matters should also be described. A discussion should be provided on the COL applicant's plans pertaining to (1) approval of test data for each major test phase before proceeding to the next test phase and (2) approval of test data at each power test plateau (during the power-ascension phase) before increasing power level.
- 260.92 Section 14.2.3.3, "Test Records", appears to contradict the test records retention provisions specified in RG 1.28, "Quality Assurance Program Requirements (Design and Construction)," Rev. 3. Westinghouse should revise the text in this section in order to remain consistent with its commitment to RG 1.28, Rev. 3.

260.93 Section 14.2.5, "Utilization of Reactor Operating and Testing Experience in the Development of Test Program," states that "special tests" used to establish a unique performance parameter of the AP600 design that will not change from plant to plant are to be performed on the first plant only. Westinghouse should revise this section to include the following:

- a) Selection (screening) criteria used by Westinghouse to identify such special tests
- b) Provisions or programmatic controls that will be utilized by Westinghouse and/or the COL applicant to establish that system configuration or design engineering changes do not invalidate previous special test results.

260.94 Section 14.2.9.1.1, "Reactor Coolant System Testing" should be modified to address the following:

- a) This section describes integrity and leakage testing of the system, but does not indicate how this testing is to be performed. Specifically, the methods described in the abstract do not indicate whether this testing includes calibration and operability verification of the plant leak detection systems in accordance with RG 1.68, Appendix A, Paragraph 1.j.(5). An earlier version of the AP600 ITP (Revision 1, dated January 13, 1994) included a leak detection test description for both pre-operational and startup plant modes. It should also be noted that the CESSAR System 80+ utilized a "Pre-core" and "Post-core" Reactor Coolant System Leak Rate Measurement. The AP600 SSAR Chapter 14 ITP should include a leak detection test description for pre- and post-fuel-load plant modes.
- b) Under "Purpose" section the third bullet should be modified as follows:
 - Measure process parameters required for safety-related actuation and safe shutdown as described in SSAR Sections 7.2, 7.3 and 7.4
- c) Under "Purpose" section add a new bullet as follows:
 - Verify safety-related interlocks as described in SSAR Section 7.6
- d) Under "General Test Methods and Acceptance Criteria" item (g) add three new bullets as follows:
 - Normal RHR isolation valve interlock
 - Passive RHR heat exchanger inlet isolation valve interlock
 - CMT cold leg balance line isolation valve interlock

- 260.95 Section 14.2.9.1.2, "Steam Generator System Testing," states that part of its purpose is to verify that the system can remove heat from the reactor coolant system. This abstract should be modified to demonstrate the heat removal capability of the turbine bypass valves and the atmospheric dump valves, or to show where such testing is demonstrated, per RG 1.58, App. A, 1.d.(1) and 1.d.(2).
- 260.96 Section 14.2.9.1.6, "Main Control Room Emergency Habitability System Testing," should be modified to provide frequency of testing and toxic monitoring provision for VES.
- 260.97 Section 14.2.9.1.12, "Protection and Safety Monitoring System (PMS) Testing," should be modified to address the following:

- a) Under "Purpose" section, it is stated that the test will also verify defense-in-depth functions described in SSAR Section 7.1 which includes:

- Provide data from the safety-related sensors to the plant control system
- Provide information to the data display and processing system
- Provide data to the monitor bus for use by other systems within the plant.

The above functions should be included in the "General Test Methods and Acceptance Criteria" section.

- b) Under "Prerequisites" section, it is stated that required cabinet field wiring is electrically isolated to prevent operation of components controlled by the PMS. Additional clarification should be provided with respect to "electrically isolated." The following issues should be considered:
- The test procedures should not require disconnecting wires, installing jumpers, or other similar modifications of the installed equipment.
 - Tests conducted should use only permanently installed test equipment.
- c) Item (j) of the "General Test Methods and Acceptance Criteria" should include a test to verify "Bypass and Inoperable Status" as part of PMS abnormal operating conditions verification.
- d) Item (l) of the "General Test Methods and Acceptance Criteria" should specify the inter-cabinet communication to be tested. This test will verify the acceptable performance of the isolated fiber-optic data communication link between the following:

- The integrated protection cabinets to and from the engineered safety features actuation cabinets.
 - The engineered safety features actuation cabinets to and from the protection logic cabinets.
 - The protection logic cabinets to and from the protection multiplexer cabinets.
- e) An item should be added to verify the bypass logic that allows the system to meet the single failure criterion with one or two channels bypassed for testing or maintenance as described in SSAR Section 7.1.2.10, "Fault Tolerance, Maintenance, Test and Bypass."
- f) An item of "Timing Requirement" should be added under the "General Test Methods and Acceptance Criteria". Digital system architecture should account for communication time between components of the system. The digital instrumentation loop often includes the sensor, transmitter, A/D converter, multiplexer, data communication equipment, demultiplexer, memory devices, controls and displays. Therefore, timing analysis should consider the entire loop.

260.98 Section 14.2.9.1.13, "Incore Instrumentation System Testing," should be modified to address the following:

- a) As defined in SSAR Section 7.1, the primary function of the incore instrumentation system is to provide a three-dimensional flux map of the reactor core. This map is used to calibrate neutron detectors used by the protection and safety monitoring system, as well as to optimize core performance. A secondary function of the incore instrumentation system is to provide the protection and safety monitoring system with thermocouple signals necessary for the post-accident inadequate core cooling monitor. Therefore, the "Purpose" section of system testing should include these functions.
- b) The "General Test Methods and Acceptance Criteria" should address tests to verify the functions of the Incore Instrumentation System stated in item a) above.

260.99 Section 14.2.9.1.14, "Class 1E DC Power and Uninterruptable Power Supply Testing," and Section 14.2.9.2.16, "Non-Class 1E DC Power and Uninterruptable Power Supply Testing," should be modified to demonstrate testing of instrumentation and alarms, ground detection, and permissive and prohibitive interlocks per RG 1.68, App. A, 1.g.(4).

- 260.100 Section 14.2.9.2.1, "Main Steam System Testing," should be modified to include testing of the turbine control and intercept valves as discussed in Attachment 3 to the Westinghouse letter of July 16, 1996, per RG 1.68, App. A, 1.e.(6).
- 260.101 Section 14.2.9.2.3, "Chemical and Volume Control System Testing," should be modified to reinstate testing of the purification and cleanup functions of the CVCS per RG 1.68, App. A, 1.n.(10).
- 260.102 Section 14.2.9.2.7, "Spent Fuel Pool Cooling System Testing," should be modified to reinstate testing of the operability of gates and drains and to perform leak tests of gates, drains, and gaskets per RG 1.68, App. A, 1.m.(3).
- 260.103 Section 14.2.9.2.9, "Central Chilled Water System Testing," should be modified to include testing of the high capacity portion of the system.
- 260.104 Section 14.2.9.2.10, "Nuclear Island Nonradioactive Ventilation System Testing," should be modified to provide frequency of testing and radiation and toxic monitoring provision for VES.
- 260.105 Section 14.2.9.2.13, "Data Display and Processing System Testing," should be modified to add an item regarding "Timing Requirement" under the "General Test Methods and Acceptance Criteria". Digital system architecture should account for communication time between components of the system. The digital instrumentation loop often includes the sensor, transmitter, A/D converter, multiplexer, data communication equipment, demultiplexer, memory devices, controls and displays. Therefore, timing analysis should consider the entire loop.
- 260.106 Section 14.2.9.2.14, "Diverse Actuation System Testing," should be modified to address the following:
- a) The "General Test Methods and Acceptance Criteria" for automatic DAS actuation should be consistent with SSAR Section 7.7.1.11 description. The test method should define the actuation functions with the corresponding parameters. These actuation functions include the following:
 - Trip rods via the motor generator set, and trip turbine and initiate the passive residual heat removal on low wide range steam generator water level
 - Initiate passive residual heat removal on high hot leg temperature
 - Actuate the core makeup tanks, and trip the reactor coolant pumps on low pressurizer water level

- Isolate critical containment penetrations and start passive containment cooling water flow on high containment temperature
- b) The "General Test Methods and Acceptance Criteria" should include a procedure to verify that diversity for DAS is achieved by the use of a different architecture, different hardware implementation and different software from that of the protection and safety monitoring system.
- c) The "General Test Methods and Acceptance Criteria" should include a procedure to verify the diverse indications for the following parameters:
 - Steam generator water level
 - Hot leg temperature
 - Core exit temperature
 - Pressurizer level
 - Containment temperature
 - Containment hydrogen concentration
- d) The "General Test Methods and Acceptance Criteria" should include a procedure to verify the DAS and the protection and safety monitoring system use independent and separate uninterruptable power supplies.
- e) The "General Test Methods and Acceptance Criteria" should include a procedure to verify that the DAS uses sensors that are separate from those used by the PMS and the plant control system.

260.107 Section 14.2.9.2.15, "Main AC Power System Testing," is limited to testing of the diesel backed buses and associated load centers and motor control centers. Testing of the normal AC power distribution system in accordance with RG 1.68, Appendix A, Paragraph 1.g.(1) is not addressed in that electrical system performance, including interlocks, protective devices, initiating devices, transfer devices, relays, logic and other elements of the normal and preferred AC power system are not tested upstream of the diesel backed buses.

260.108 Section 14.2.9.2.17, "Diesel Generator Testing," should be modified to address the following:

- a) The abstract should include a reference to Section 9.4.10 for appropriate design criteria related to the diesel ventilation systems (GTM&AC Item f).
- b) The abstract should reinstate that the proper automatic restart of the diesel is to be tested *immediately* following the load test (GTM&AC Item k) per RG 1.108, C.2.a.(5).

- c) The abstract should reinstate appropriate start tests per RG 1.108, C.2.a.(9).
- d) The abstract should include the statement: "Demonstrate by performing a loaded run of the diesel generator with its day tank filled to its low level alarm point, that the day tank provides sufficient fuel for at least 2 hours of diesel generator operation with the diesel generator supplying its expected power requirements."

260.109 Section 14.2.9.2.19, "Plant Lighting System Testing," is limited to testing of the main control room and remote shutdown station emergency lighting systems. As described in SSAR Section 9.5.3, emergency lighting is also provided for emergency ingress and egress, equipment areas associated with power recovery actions (e.g., diesel building), as well as for manual equipment actions in the event of a fire with loss of normal lighting. These self-contained lighting units support safe shutdown operations and should be included in the pre-operational testing to verify performance and proper positioning.

260.110 Section 14.2.9.2.20, "Primary Sampling System Testing," should be modified to test laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations per RG 1.68, App. A, 1.k.(3).

260.111 Section 14.2.9.3.3, "Solid Radwaste System Testing," should be modified to verify that no free liquids are present in the packaged wastes per RG 1.68, App. A, 1.l.(3).

260.112 Section 14.2.9.3.4, "Radioactive Waste Drain System Testing," should be revised to address the following:

- a) Section 9.3.5 should be added as a reference in the Purpose and General Test Acceptance Criteria and Methods sections.
- b) The following statement should be added: "Flow water in each drain path to verify that the drains discharge to their designated destination and that system segregation is maintained."

260.113 Section 14.2.9.3.6, "Waste Water System Testing," should be revised to address the following:

- a) Section 9.2.9 should be added as a reference in the Purpose and General Test Acceptance Criteria and Methods sections.
- b) The following statement should be added: "Verify the ability of the turbine building drain tanks to provide an alarm and trip the drain tank pumps and the waste water retention basin pumps on detection of radiation in the drain tanks."

- 260.114 Section 14.2.9.4.6, "Circulating Water System Testing," should be modified to include testing of cooling towers and associated auxiliaries as discussed in Attachment 3 to the Westinghouse letter of July 16, 1996 per RG 1.68, App. A, 1.f.(2).
- 260.115 Section 14.2.9.4.12, "Containment Air Filtration System Testing," should be revised to specifically include testing of the system filters, consistent with the testing described for other ventilation systems.
- 260.116 Section 14.2.9.4.14, "Mechanical Handling System Crane Testing," describes testing of the reactor building polar crane and other hoists. The test abstract does not address testing of the auxiliary building cranes, including the jib and cask cranes, in accordance with RG 1.68, Appendix A, Paragraphs, 1.m.(2), 1.m.(4), and 1.o.(1). In addition, the term "reactor building polar crane" is inconsistent with the "containment polar crane" terminology in SSAR Section 9.1.
- 260.117 Section 14.2.9.4.15, "Seismic Monitoring System Testing," should be modified to address the following issue. SSAR Section 3.7.4.2 states that the solid-state recording and analysis system has internal batteries and charger to prevent the loss of data during a power outage, and to allow data collection and analysis in a seismic event during which power fails. The "General Test Methods and Acceptance Criteria" should include a procedure to simulate power outage and to verify the system response as stated in the SSAR.