

## **17. QUALITY ASSURANCE**

### **17.1 Quality Assurance During the Design and Construction Phase**

In the AP1000 Design Control Document (DCD) Tier 2, Section 17.5, "Combined License Information Items," Westinghouse (the applicant) states that the combined license (COL) applicant will address its quality assurance (QA) program for the design phase, as well as its QA program for procurement, fabrication, installation, construction, and testing of structures, systems, and components (SSCs) in the facility. Therefore, when applying for a COL, the staff will expect the COL applicant to submit its design phase QA program for review, in addition to the information needed to support the staff's review of the COL applicant's QA program for construction and operation of the facility. DCD Tier 2, Section 17.5, describes this COL action item. The U.S. Nuclear Regulatory Commission (NRC) staff agrees that the COL applicant is responsible for this part of the QA program and that making this a COL action item in DCD Tier 2, Section 17.5, is acceptable. This is COL Action Item 17.1-1.

### **17.2 Quality Assurance During the Operations Phase**

In DCD Tier 2, Section 17.5, the applicant stated that the COL applicant will address its QA program for operations. DCD Tier 2, Section 17.5, describes this COL action item. The NRC staff agrees that the COL applicant is responsible for developing the operational QA program pursuant to Title 10 of the Code of Federal Regulations (10 CFR) Subsection 52.79(b) and 10 CFR 50.34(a)(7). Therefore, making this a COL item in DCD Tier 2, Section 17.5, is acceptable. This is COL Action Item 17.2-1.

### **17.3 Quality Assurance During the Design Phase**

Title 10 of the Code of Federal Regulations (10 CFR) Subsection 52.47(a)(1)(i) requires, in part, that an application for design certification contain technical information which is required of applicants for construction permits and operating licenses by 10 CFR Part 50 and its appendices. The requirements of 10 CFR 50.34(a)(7) state, in part, that an applicant for a construction permit provide a description of the QA program to be applied to the design of SSCs. In addition, 10 CFR Part 52, Appendix O, "Standardization of Design: Staff Review of Standard Designs," states that the information submitted pursuant to Subsection 50.34(a)(7) shall be limited to the QA program to be applied to the design, procurement and fabrication of the SSCs for which the design review has been requested. The description of the QA program shall include a discussion of how it will satisfy the applicable requirements of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." Therefore, the staff reviewed the QA program used during the AP1000 design phase. Section 17.3, "Quality Assurance Program Description," of NRC technical report designation (NUREG)-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," (SRP) contains specific guidance for conducting this review.

#### **17.3.1 General**

DCD Tier 2, Section 17.3, outlines the QA program applicable to the design, procurement, fabrication, inspection, and/or testing of items and services for the AP1000 project. The design for the AP1000 is based on using the design of the AP600 to the maximum extent possible. As

## Quality Assurance

a result, the applicant stated that it has used a continuous QA program spanning the AP600 design, as well as the AP1000 design. Before March 31, 1996, activities for the AP600/AP1000 design program were performed in accordance with topical report WCAP-8370, "Westinghouse Energy Systems Business Unit/Power Generation Business Unit Quality Assurance Plan." Since March 31, 1996, activities affecting the quality of items and services for the AP1000 project during design, procurement, fabrication, inspection, and/or testing have been performed in accordance with the quality plan described in "Westinghouse Energy Systems Business Unit—Quality Management System." Since that time, the quality management system (QMS) has been maintained as the quality plan for the AP1000 program, and subsequent revisions have been submitted to and accepted by the NRC staff as meeting the requirements of 10 CFR Part 50, Appendix B. Revision 5, the current revision of the Westinghouse QMS, was implemented on October 1, 2002. The NRC staff previously had found that Revision 5 of the QMS continued to meet the requirements of 10 CFR Part 50, Appendix B, as documented in an NRC evaluation letter dated September 13, 2002, from W. Ruland to H. Sepp (ADAMS Accession No. ML022540895).

### 17.3.2 Evaluation

During the review of the AP1000 design QA program, the staff identified five areas where it required additional information to complete the QA program description and implementation review. These areas included (1) QA controls for non-safety-related, risk-significant SSCs identified by the regulatory treatment of non-safety systems (RTNSS) process defined in SECY-95-132, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Designs," dated May 22, 1995, (2) implementation of QA controls for AP1000 design testing, (3) implementation of the Westinghouse QMS for AP1000 design activities, (4) the basis for certain exceptions to quality-related regulatory guides, and (5) missing quality-related information in DCD Tier 2, Section 17.6, "References." In letters dated September 19, 2002, and April 16, 2003, the staff requested additional information to complete this review. The description and resolution of each of these five areas follow:

- Quality Assurance Controls for Structures, Systems, and Components Identified by the Regulatory Treatment of Non-Safety Systems Process

The NRC staff reviewed the QA controls applicable to the SSCs within the RTNSS process to verify that adequate controls were specified to ensure the reliability and availability of risk-significant, non-safety-related SSCs. The staff utilized the guidance in SECY-95-132, which the Commission approved in a Staff Requirements Memorandum dated June 28, 1995, to facilitate this review. As described in SECY-95-132, the staff will consider graded requirements for QA and quality control consistent with the importance to safety of the systems identified by the RTNSS process. The applicant described QA controls for certain non-safety-related SSCs in DCD Tier 2, Table 17-1, "Quality Assurance Program Requirements for Systems, Structures, and Components Important to Investment Protection." The staff determined that the DCD Tier 2, Table 17-1, QA controls were generally consistent with the QA measures specified for non-safety-related SSCs in Generic Letter (GL) 85-06, "Quality Assurance Guidance for ATWS Equipment That Is Not Safety Related," and Regulatory Guide (RG) 1.155,

“Station Blackout.” Therefore, the staff determined that DCD Tier 2, Table 17-1, specified adequate graded QA controls for SSCs identified by the RTNSS process. However, in reviewing DCD Tier 2, Section 17.3, the staff determined that the applicant previously had revised the DCD Tier 2 information to remove SSCs within the RTNSS process from the scope of non-safety-related quality control requirements outlined in DCD Tier 2, Table 17-1. Because this revision eliminated the QA controls for SSCs within the RTNSS process, the staff determined that this DCD Tier 2 revision was not acceptable.

In request for additional information (RAI) 260.001, the NRC staff requested the applicant to either justify removal of SSCs identified by the RTNSS process from DCD Tier 2, Section 17.3, or to maintain the SSCs identified by the RTNSS process within the scope of the non-safety-related QA controls outlined in DCD Tier 2, Table 17-1. In a revision to DCD Tier 2, Section 17.3, the applicant placed SSCs identified by the RTNSS process within the scope of DCD Tier 2, Table 17-1. The NRC staff found that this meets the guidance in SECY-95-132 and SRP Section 17.3, and, therefore, is acceptable. On this basis, RAI 260.001 is resolved.

- Quality Assurance Issues Associated with AP1000 Design Testing

To support design certification of the AP1000 design, Westinghouse performed thermal hydraulic testing at the Advanced Plant Experiment (APEX)-1000 test facility, which the Oregon State University (OSU) Advanced Thermal Hydraulic Research Laboratory (ATHRL) operates in Corvallis, Oregon. To verify that these testing activities were in accordance with the Westinghouse QA program under 10 CFR Part 50, Appendix B, as described in DCD Tier 2, Chapter 17, the NRC staff performed a QA implementation inspection of the OSU ATHRL. The staff had previously identified performance of this inspection as draft safety evaluation report (DSER) Open Item 17.3.2-1.

From September 30–October 2, 2003, the NRC staff performed a QA inspection at the OSU ATHRL. The NRC performed the inspection to review the implementation of the OSU ATHRL quality plan as it relates to facility scaling and testing activities conducted in support of the Westinghouse AP1000 design certification. Westinghouse reviewed and accepted the ATHRL quality plan as meeting the requirements of 10 CFR Part 50, Appendix B for the AP1000 project activities. The NRC staff reviewed the areas covered by the ATHRL quality plan to confirm that test activities were adequately controlled, APEX-1000 test facility personnel were properly trained, and test data were properly recorded and maintained.

During this inspection, the NRC found that certain activities did not meet NRC requirements. For example, the ATHRL did not have a documented process or procedure to address the requirements of 10 CFR Part 21, “Reporting of Defects and Noncompliance,” for facility scaling and testing activities performed at the APEX-1000 test facility. This issue was identified as Notice of Violation 99901351/2003-01-01 in NRC Inspection Report 99901351/2003-01 (ADAMS Accession No. ML033350274). In addition, the inspectors determined that certain activities at the ATHRL APEX-1000 test

## Quality Assurance

facility were not conducted in accordance with NRC quality requirements. Specifically, the OSU ATHRL quality plan failed to establish a corrective action program consistent with the requirements of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action." It also failed to establish requirements for training record retention consistent with Criterion XVII, "Quality Assurance Records." In addition, OSU ATHRL staff could not produce the objective evidence necessary to demonstrate compliance with the ATHRL quality plan for drawing configuration control, control of measurement and test equipment, computer software control, and document control for certain APEX-1000 testing activities. The NRC inspection report identified these issues in Notice of Nonconformance 99901351/2003-01-01 and Notice of Nonconformance 99901351/2003-01-02.

On the basis of the findings identified in NRC Inspection Report 99901351/2003-01, the staff requested the OSU ATHRL to respond to the Notice of Violation and Notices of Nonconformance. In addition, the NRC requested Westinghouse to verify that the OSU ATHRL quality plan implemented for the AP1000 thermal-hydraulic testing was consistent with the Westinghouse QA program, as described in DCD Tier 2, Chapter 17. The staff required this information to resolve DSER Open Item 17.3.2-1.

OSU responded to the Notice of Violation and the two Notices of Nonconformance in letters to the NRC staff dated December 22 and December 23, 2003, and January 30, 2004 (ADAMS Accession Nos. ML033640531, ML033640533, and ML040350550, respectively). The staff reviewed the responses and determined that OSU adequately addressed the deficiencies noted during the inspection. In particular, OSU stated that it had issued a procedure compliant with 10 CFR Part 21 and revised the ATHRL quality plan to include a corrective action program and retention requirements for training records. In addition, OSU stated that it revised the quality plan to provide clear guidance for changes to test procedures and completed a walkdown to verify that the APEX-1000-controlled drawings reflected the as-built facility configuration. OSU also clarified corrective measures taken to address weaknesses in the control of measurement and test equipment, and clarified the methodology used to validate software for the APEX-1000 test facility. On the basis of the NRC staff review of the corrective actions and preventive measures implemented in the OSU response to Notice of Violation 99901351/2003-01-01, Notice of Nonconformance 99901351/2003-01-01, and Notice of Nonconformance 99901351/2003-01-02, the staff concludes that the identified findings do not significantly affect the integrity or reliability of the facility test data. Therefore, DSER Open Item 17.3.2-1 is resolved.

- Implementation of Quality Assurance Program for AP1000 Design

On September 15–18, 2003, the NRC staff conducted an AP1000 QA implementation inspection at the Westinghouse Energy Center in Monroeville, Pennsylvania. NRC Inspection Report 99900404/2003-01 (ADAMS Accession No. ML033090510) documents the results of the inspection. The NRC conducted the inspection to review implementation of the Westinghouse AP1000 project-specific quality plan and to verify that design activities conducted on the AP1000 project complied with the Westinghouse

QMS and the requirements of 10 CFR Part 50, Appendix B. The staff previously identified performance of this inspection as DSER Open Item 17.3.2-2.

The inspection team evaluated Westinghouse's oversight of design activities conducted by contractors and subcontractors, evaluation and disposition of Westinghouse internal audit findings, and implementation of corrective actions taken as a result of these audit findings. During the inspection, the NRC staff sampled the implementation of AP1000 project activities to verify that they met the QA requirements specified in 10 CFR Part 50, Appendix B, and 10 CFR 50.34(f)(3)(iii). In addition, the staff reviewed the applicant's compliance with the QA guidelines specified in NUREG-0933, "A Prioritization of Generic Safety Issues," Item I.F.2, "Develop More Detailed QA Criteria."

Regarding the requirements of 10 CFR 50.34(f)(3) and the guidance in NUREG-0933, Item I.F.2, the inspectors verified that QA personnel were involved in the approval of QA procedures. The Westinghouse Passive Plant Project and Development Staff prepared the QA procedures for the AP1000 project. Qualified QA personnel independently reviewed the procedures. Either the Passive Plant Project and Development Manager or the Westinghouse AP600 and AP1000 Projects Director signed the procedures. In addition, QA personnel reviewed design change proposals in accordance with AP1000 Program Operating Procedure AP-3.2, "Change Control for the AP1000 Program." The staff could not review information on QA personnel involved in construction, installation, testing, and operation activities because this is a COL applicant responsibility. The size of the QA staff involved in the AP1000 design certification project is adequate; however, the COL applicant will be responsible for QA staffing during the COL applicant design and construction phases. In addition, Westinghouse QA organizational reporting levels were determined to be adequate for the AP1000 design certification; however, the COL applicant will need to verify that QA organizational reporting levels are sufficient during the design and construction phases. This is COL Action Item 17.5-1 (see Section 17.5 of this report for additional details). Chapter 20, "Generic Issues," of this report contains further discussion of the applicant's compliance with NUREG-0933, Item I.F.2, guidance.

In reviewing the control of suppliers for the AP1000 project, the inspectors determined that Westinghouse could not produce objective evidence demonstrating compliance with Westinghouse quality program requirements for qualifying and evaluating suppliers used to support safety-related design certification activities for the AP1000 project. Specifically, as of August 19, 2003, the AP1000 suppliers list showed a total of 27 suppliers; however, Westinghouse could not produce objective evidence demonstrating that it had evaluated and audited 21 of the suppliers potentially active in providing safety-related services for the AP1000 Design Certification Program in ways consistent with Westinghouse procedures. The issue was identified as Notice of Nonconformance 99900404/2003-01-01. The inspectors also identified potential weaknesses in the applicant's audit and self-assessment programs. Specifically, the audit discussed in Westinghouse Electric Company (WEC) 02-20, performed on July 18, 2003, failed to identify the inadequacies in the AP1000 supplier qualification program

## Quality Assurance

that the inspectors later identified. In addition, the inspectors questioned whether a self-assessment for calculation quality met its prescribed objectives.

In letters dated December 3, 2003, and January 9 and February 6, 2004, Westinghouse responded to the issues identified by the inspectors (ADAMS Accession Nos. ML033440410, ML040140764, and ML040430245, respectively). The Westinghouse responses provided the following additional information:

- Regarding Notice of Nonconformance 99900404/2003-01-01, Westinghouse stated that noncompliance of lower tier AP1000 project-specific QA supplier qualification procedures with the higher tier Westinghouse QMS implementing procedures for supplier verification caused the failure to appropriately identify AP1000 suppliers. To correct this issue, Westinghouse stated that it had revised the AP1000 project-specific supplier qualification procedures, and that all safety-related AP1000 suppliers were qualified in accordance with the Westinghouse QMS. Westinghouse stated that it had established, for each non-Westinghouse AP1000 program contributor, a folder containing the following QA information:
  - documented evidence of Westinghouse's evaluation that the contributor's QA program meets the requirements of 10 CFR Part 50, Appendix B.
  - evidence of other independent audits performed on the contributor by other audit organizations (e.g., NQA-1 or ISO-9001 certification)
  - evaluation of previous work performed for AP600 and AP1000 and the current AP1000 evaluations based on a review of current work
  - documentation of Westinghouse audits performed on the contributor

Westinghouse uses the folder to establish and maintain objective evidence that the AP1000 project contributors satisfy the applicable requirements of 10 CFR Part 50, Appendix B and the applicable design certification provisions of 10 CFR Part 52.

- Regarding the failure of Westinghouse internal audit WEC-02-20 to document the inspector-identified deficiencies in AP1000 supplier qualification, Westinghouse stated that the internal audit focused on compliance with the lower tier AP1000 project-specific procedures, rather than on compliance with QMS requirements. Because the lower tier AP1000 project-specific supplier qualification procedures did not comply with higher tier QA procedures, the internal audit failed to reveal that AP1000 supplier qualification was not performed in ways consistent with QMS requirements. Westinghouse stated that it has revised the lower tier AP1000 project procedures, and that this issue has been entered in the Westinghouse corrective action program to examine the scope of audits to ensure that they have the appropriate breadth and focus.

- Westinghouse also clarified the intent and approach used for the self-assessments, and the NRC staff determined that the approach used by Westinghouse for the self-assessments was acceptable.

The NRC staff found that the corrective actions taken by Westinghouse were reasonable and adequately addressed the issues identified during the QA implementation inspection. Therefore, DSER Open Item 17.3.2-2 is resolved.

- Compliance with Regulatory Guides Related to Quality Assurance

The NRC staff reviewed DCD Tier 2, Appendix 1A, "Conformance with Regulatory Guides," and noted that the applicant had taken exceptions to regulatory positions in several QA-related RGs. Specifically, the applicant identified exceptions to quality control guidance in the following five RGs:

- (1) RG 1.28, "Quality Assurance Program Requirements (Design and Construction)"
- (2) RG 1.37, "Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants"
- (3) RG 1.38, "Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants"
- (4) RG 1.39, "Housekeeping Requirements for Water-Cooled Nuclear Power Plants"
- (5) RG 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants"

The staff's evaluation of the exceptions to each of these RGs follows.

Exception to RG 1.28: As noted previously in this chapter, in DCD Tier 2, Appendix 1A, the applicant took exception to the record retention recommendations in RG 1.28. Specifically, RG 1.28, Regulatory Position C.2, "Quality Assurance Records," states that programmatic, nonpermanent records should be retained for at least 3 years. For programmatic, nonpermanent records, the retention period should be considered to begin upon completion of the activity. In addition, RG 1.28 states that product and programmatic, nonpermanent records should be retained at least until the date of issuance of the full-power operating license of the unit. Under 10 CFR Part 52, issuance of a COL is comparable to issuance of a full-power operating license under 10 CFR Part 50. The applicant stated that because a definitive schedule for obtaining a full-power operating license does not exist, the record retention plan is keyed to the final design approval. The applicant stated that a 3-year programmatic record retention period will be initiated on the date that the NRC issues an AP1000 final design approval. The NRC staff determined that this exception to RG 1.28 may not be acceptable because programmatic, nonpermanent records could be discarded 3 years after issuance of a final design approval. Therefore, these records may not be available to a

## Quality Assurance

future COL applicant. The NRC staff requested additional information (RAI 260.007) to assess the basis for not retaining nonpermanent records until a COL is issued. This issue was identified as DSER Open Item 17.3.2-3.

Westinghouse revised DCD Tier 2, Appendix 1A to state that the QA records will now conform to RG 1.28 and Appendix B, Criterion 17, "Quality Assurance Records." On the basis of this revision to DCD Tier 2, Appendix 1A, the NRC staff determined that DSER Open Item 17.3.2-3 is resolved.

Exceptions to RGs 1.37, 1.38, and 1.39: These RGs reference use of American National Standards Institute (ANSI) Standards N45.2-1, N45.2-2, and N45.2-3. However, the applicant referenced the requirements in American Society of Mechanical Engineers (ASME) Quality Standards, NQA-1 and NQA-2, rather than these ANSI standards. The requirements in ANSI N45.2-1, N45.2-2, and N45.2-3 have been updated and incorporated into ASME Quality Standards, NQA-1 and NQA-2. Because the staff considered incorporation of these ANSI standards into the guidance in ASME NQA-1 and NQA-2 as enhancements, the NRC staff finds that these RG exceptions are acceptable. The staff also noted that these three RGs are associated with COL activities. Therefore, the staff asked the applicant to annotate the discussion of RGs 1.37 and 1.38 in DCD Tier 2, Appendix 1A to indicate the need for a COL applicant to address implementation of these RGs, using an annotation similar to that in RG 1.39. The applicant revised DCD Tier 2, Appendix 1A, to add the reference to the COL information in DCD Tier 2, Section 17.5, similar to the annotation for RG 1.39. For these reasons, the NRC staff finds that the exceptions to RGs 1.37, 1.38, and 1.39 are acceptable.

Exception to RG 1.54, Revision 1: The NRC staff found that the applicant took exception to RG 1.54, Revision 1. As described in DSER Section 6.1.2.1, "Protective Coatings," the staff determined that the applicant met the QA requirements of 10 CFR Part 50, Appendix B, for safety-related protective coatings inside containment. However, some coatings inside containment are non-safety-related in the AP1000 design. The applicant addressed this exception to RG 1.54 in its response to RAI 281.001 (see Section 6.1.2, "Protective Coating Systems (Paints) - Organic Materials," of this report for additional details). The NRC staff found that this exception to RG 1.54 is acceptable based on the staff evaluation in Section 6.1.2 of this report.

- Missing Information Related to Quality Assurance in DCD Tier 2, Section 17.6, "References"

The NRC staff also noted that in DCD Tier 2, Section 17.6, "References," the applicant did not reference the following documents discussed in DCD Tier 2, Section 17.3:

- "Westinghouse Electric Company Quality Management System (QMS)," Revision 5, dated October 1, 2002

- WCAP-15985, “AP1000 Implementation of the Regulatory Treatment of Non-Safety-Related Systems Process,” Revision 2, dated August 2003

Because these references were associated with QA program elements, the NRC staff asked Westinghouse to add these references to DCD Tier 2, Section 17.6. In addition, the staff noted that the DCD contained no reference to a project-specific quality plan for the AP1000 design similar to Reference 4, WCAP-12600, “AP600 Advanced Light Water Reactor Design Quality Assurance Program Plan,” Revision 4, dated January 1998. The NRC requested this information from Westinghouse in RAI 261.008. This issue was identified as DSER Open Item 17.3.2-4.

In a revision to DCD Tier 2, Section 17.6, “References,” Westinghouse added Item 9, “Westinghouse Electric Company Quality Management System (QMS),” Revision 5, dated October 1, 2002. Therefore, Westinghouse is implementing their QMS in accordance with 10 CFR Part 50, Appendix B QA program for the AP1000 design. The staff finds this reference document acceptable for implementing a project-specific quality plan for the AP1000 design.

In its response, Westinghouse stated that WCAP-15985 is a reference document on the docket for the AP1000 design (ADAMS Accession No. ML023370584); therefore, DCD Tier 2, Section 17.6 need not reference this document. Further, Westinghouse noted that DCD Tier 2, Chapter 16, “Technical Specification,” (TS) contains a reference to WCAP-15985 in TS Bases 3.3.5 for the diverse actuation system. The NRC staff concluded that the DCD adequately referenced WCAP-15985 and that DCD Tier 2, Section 17.6 need not list this item. This resolves Open Item 17.3.2-4.

### **17.3.3 Conclusions**

The staff determined that Westinghouse maintains a QA program reviewed and approved by the NRC that complies with the requirements of 10 CFR Part 50, Appendix B. Furthermore, the staff concludes that Westinghouse provided an adequate basis for all exceptions to the regulatory positions contained in QA-related RGs. On the basis of inspections performed at the OSU ATHRL in Corvallis, Oregon, and Westinghouse offices in Monroeville, Pennsylvania, the staff has reasonable assurance that Westinghouse adequately implemented QA controls for testing and design activities. Regarding the QA controls applied to non-safety-related SSCs within the RTNSS process, the staff concludes that Westinghouse identified appropriately graded QA guidelines for this risk-significant equipment.

## **17.4 Reliability Assurance Program During the Design Phase**

SECY-95-132 outlines the requirements for a design certification reliability assurance program (RAP). The RAP provides reasonable assurance that (1) an advanced reactor is designed, constructed, and operated in a manner that is consistent with the assumptions and risk insights for risk-significant SSCs; (2) the risk-significant SSCs do not degrade to an unacceptable level

## Quality Assurance

during plant operations, (3) the frequency of transients that challenge advanced reactor SSCs are minimized, and (4) risk-significant SSCs function reliably when challenged.

The RAP for advanced reactors is implemented in two stages. The first stage, the design RAP (D-RAP), applies before the initial fuel load; the second stage, the operational reliability assurance process (O-RAP), applies to reliability assurance activities for the operations phase of the plant life cycle. The NRC staff reviews the D-RAP during design certification and the O-RAP during the COL stage.

The NRC staff drafted SRP Section 17.4, "Reliability Assurance Program," dated April 1996, to provide guidance for reviewing RAPs. The NRC staff's evaluation of the Westinghouse AP1000 RAP is based on the staff positions discussed in SECY-95-132 and the guidance in draft SRP Section 17.4. An application for advanced reactor design certification or a combined license must contain the following:

- the description of the RAP used during the design that includes scope, purpose, objectives, and essential elements of the D-RAP
- the process used to evaluate and prioritize the structures, systems, and components in the design on the basis of their degrees of risk significance
- a list of the structures, systems, and components designated as risk significant
- for the structures, systems, and components designated as risk significant, (1) a process for determining dominant failure modes that considered industry experience, analytical models, and applicable requirements, and (2) key assumptions and risk insights from probabilistic, deterministic, or other methods that considered operation, maintenance, and monitoring activities

The NRC staff reviewed the proposed D-RAP for the AP1000 design using the guidance in draft SRP Section 17.4 and SECY-95-132. The NRC staff also reviewed information from the AP1000 probabilistic risk assessment (PRA), Chapter 50, "Importance and Sensitivity Analysis," deterministic methods, and expert judgment from all chapters of the DCD to evaluate whether all risk-significant SSCs had been identified for inclusion in the D-RAP for the AP1000 design.

### **17.4.1 General**

In a revision of DCD Tier 2, Section 17.4.1, Westinghouse stated that the D-RAP, as shown in DCD Tier 2, Figure 17.4-1, is implemented in three phases. The first phase, Design Certification, defines the overall structure of the AP1000 D-RAP and implements the aspects of the program that apply to the design process. During this phase, risk-significant SSCs are identified for inclusion in the program by using probabilistic, deterministic, and other methods. Phase II, the post-design certification process, develops component maintenance recommendations for the plant's operation and maintenance activities for identified SSCs. The third phase is the site-specific phase, which introduces the plant's site-specific SSCs to the

D-RAP process. The designer performs Phase I. The COL applicant is responsible for Phases II and III.

The NRC staff determined that the general description of RAP phases in DCD Tier 2, Section 17.4.1, meets the intent of the guidance in SECY-95-132 and the acceptance criteria in draft SRP, Section 17.4. Therefore, the general description of the D-RAP phases is acceptable.

#### **17.4.2 Scope**

In DCD Tier 2, Section 17.4.2, Westinghouse stated the following:

The D-RAP includes a design evaluation of the AP1000 and identifies the aspects of plant operations, maintenance, and performance monitoring pertinent to risk-significant SSCs. In addition to the PRA, deterministic tools, industry sources, and expert opinion are utilized to identify and prioritize those risk-significant SSCs.

The staff reviewed the AP1000 scope, purpose, objectives, and essential elements of the D-RAP in accordance with SECY-95-132 and draft SRP Section 17.4.

The NRC staff also compared the scope of SSCs under the D-RAP for the AP600 design to the scope of SSCs under the D-RAP for the AP1000 design to evaluate their differences. The NRC staff found that the scope of SSCs within the D-RAP for the two designs are very similar. However, the D-RAP for the AP1000 design added the following risk-significant component functions:

- compressed and instrument air system (CAS) air compressor transmitter
- passive containment cooling system (PCS) diverse third motor-operated drain isolation valve function
- in-containment refueling water storage tank (IRWST) vents
- normal residual heat removal (RNS) valve V055 function
- main feedwater isolation valves

The D-RAP for the AP1000 design also removed passive core cooling condensate sump recirculation valve automatic open function and normal valve position, and revised the instrumentation and control (I&C) terminology for some I&C systems (e.g., the plant protection subsystem replaces reactor trip and engineered safety feature (ESF) subsystems). The resolution of RAIs 260.002 and 260.003 discusses the scope of SSCs within the RAP for the AP1000 design (see Section 17.4.7 of this report). The NRC staff finds that DCD Tier 2, Section 17.4.2, is consistent with the provisions used to determine the scope of risk-significant

## Quality Assurance

SSCs in the D-RAP in SECY-95-132 and the acceptance criteria in draft SRP Section 17.4. Therefore, the scope of the D-RAP for the AP1000 design is acceptable.

### **17.4.3 Design Considerations**

In DCD Tier 2, Section 17.4.3, "Design Considerations," Westinghouse states the following:

As part of the design process, risk-significant components are evaluated to determine their dominant failure modes and the effects associated with those failure modes. For most components, a substantial operating history is available which defines the significant failure modes and their likely causes.

The identification and prioritization of the various possible failure modes for each component lead to suggestions for failure prevention or mitigation. This information is provided as input to the Combined License applicant's O-RAP.

The design reflects the reliability values assumed in the design and PRA as part of procurement specifications. When an alternative design is proposed to improve performance in either area, the revised design is first reviewed to provide confidence that the current assumptions in the other areas are not violated. When a potential conflict exists between safety goals and other goals, safety goals take precedence.

The NRC staff finds that these design considerations in DCD Tier 2, Section 17.4.3, are an essential element for identifying risk-significant SSCs and their failure modes, and are consistent with their descriptions in SECY-95-132 and the acceptance criteria in draft SRP Section 17.4. Therefore, these design considerations are acceptable.

### **17.4.4 Relationship to Other Administrative Programs**

In DCD Tier 2, Section 17.4.4, "Relationship to Other Administrative Programs," Westinghouse states that the D-RAP manifests itself in other administrative and operational programs. The TS contain surveillance and testing frequencies for certain risk-significant SSCs, providing confidence that the reliability values assumed for them in the PRA will be maintained during plant operations. The scope of the D-RAP includes risk-significant systems that provide defense in depth or result in significant improvement in the PRA evaluations.

Westinghouse also states that the O-RAP can be implemented through the plant's existing programs for maintenance or QA. For example, the plant's implementation of the Maintenance Rule (10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants") can provide coverage of the SSCs that the O-RAP would include. The COL applicant will be responsible for the submittal of an O-RAP to the NRC. The NRC staff will review this process as part of the plant's maintenance program, QA program, or other existing programs.

The NRC staff finds that using QA and maintenance rule programs to implement parts of the D-RAP and O-RAP, as noted in DCD Tier 2, Section 17.4.4, is consistent with the essential elements of the D-RAP, as specified in SECY-95-132 and the acceptance criteria in draft SRP Section 17.4. Therefore, these essential elements of the AP1000 D-RAP are acceptable.

#### **17.4.5 The AP1000 Design Organization**

In DCD Tier 2, Section 17.4.5, "The AP1000 Design Organization," Westinghouse stated the following:

The AP1000 organization of [DCD Tier 2,] Section 1.4 formulates and implements the AP1000 D-RAP.

The AP1000 management staff is responsible for the AP1000 design and licensing.

The AP1000 staff coordinates the program activities, including those performed within Westinghouse as well as work completed by the architect-engineers and other supporting organizations listed in [DCD Tier 2,] Section 1.4.

The AP1000 staff is responsible for development of Phase I of the D-RAP and the design, analyses, and risk and reliability engineering required to support development of the program. Westinghouse is responsible for the safety analyses, the reliability analyses, and the PRA.

The reliability analyses are performed using common databases from Westinghouse and from industry sources such as [Institute of Nuclear Power Operations] INPO and [Electrical Power Research Institute] EPRI.

The Risk and Reliability organization is responsible for developing the D-RAP and has direct access to the AP1000 staff. Risk and Reliability is responsible for keeping the AP1000 staff cognizant of the D-RAP risk-significant items, program needs, and status. Risk and Reliability participates in the design change control process for the purpose of providing D-RAP-related inputs in the design process. Additionally, a cognizant representative of Risk and Reliability is present at design reviews. Through these interfaces, Risk and Reliability can identify interfaces between the performance of risk-significant SSCs and the reliability assumptions in the PRA. Meetings between Risk and Reliability and the designer are then held to manage interface issues.

The NRC staff has reviewed the description of the AP1000 design organization and finds that DCD Tier 2, Section 17.4.5, is consistent with the description of the organizational structure needed to implement the D-RAP in SECY-95-132 and draft SRP Section 17.4. Therefore, the AP1000 design organization is acceptable.

## Quality Assurance

### 17.4.6 Objective

DCD Tier 2, Section 17.4.6, "Objective," Westinghouse states the following:

The objective of the D-RAP is to design reliability into the plant and to maintain the AP1000 reliability consistent with the NRC-established PRA safety goals.

The following goals have been established for the D-RAP:

- Provide reasonable assurance that
  - The AP1000 is designed, procured, constructed, maintained and operated in a manner consistent with the assumptions and risk insights in the AP1000 PRA for these risk-significant SSCs
  - The risk-significant SSCs do not degrade to an unacceptable level during plant operations
  - The frequency of transients that challenge the AP1000 risk-significant SSCs are minimized
  - The risk-significant SSCs function reliably when they are challenged
- Provide a mechanism for establishing baseline reliability values for risk-significant SSCs identified by the risk determination methods used to implement the Maintenance Rule (10 CFR 50.65) and consistent with PRA reliability and availability design-basis assumptions used for the AP1000 design
- Provide a mechanism for establishing baseline reliability values for SSCs consistent with the defense-in-depth functions to minimize challenges to the safety-related systems
- Generate design and operational information to be used by a Combined License applicant for ongoing plant reliability assurance activities

Development of maintenance assessments and recommendations for the D-RAP (Phase II) and the site specific portion of the D-RAP (Phase III) is the responsibility of the Combined License applicant.

The Combined License applicant is responsible for submitting its maintenance recommendations (Phase II) and site specific (Phase III) D-RAP organization description to the NRC.

The goal of the Combined License applicant's O-RAP is to maintain reliability consistent with the overall safety goals and to maintain the capability to perform safety-related functions. Individual component reliability values are expected to change throughout the course of plant life because of aging and changes in suppliers and technology. Changes in individual component reliability values are acceptable as long as overall plant safety performance is maintained within the NRC-established PRA safety goals and deterministic licensing design basis.

The NRC staff finds that the objectives outlined in DCD Tier 2, Section 17.4.6 are consistent with the objectives described in SECY-95-132 and the acceptance criteria in draft SRP Section 17.4. Therefore, these objectives are acceptable.

### **17.4.7 D-RAP Phases**

#### **17.4.7.1 D-RAP Phase I—SSC Identification and Prioritization**

The staff noted several areas where the D-RAP results for the AP1000 and the previously reviewed and approved AP600 design differed. In letters to the applicant dated September 19, 2002, and May 20, 2003, the NRC staff requested additional information on the D-RAP SSC identification results for the AP1000 design in order to evaluate these differences. The NRC staff evaluated the results for the AP600 and AP1000 D-RAP programs and concluded that the applicant adequately justified the differences. The details of the NRC staff evaluation follow.

The staff reviewed the applicant's basis for identification and prioritization of risk-significant SSCs within the scope of the D-RAP for the AP1000. In a revision of DCD Tier 2, Table 17.4-1, the applicant provided expert panel, engineering judgment, and importance measure information on the rationale for including certain SSCs within the scope of D-RAP. The NRC staff found that the probabilistic, deterministic, and engineering judgment information found in DCD Tier 2, Table 17.4-1 was comprehensive and complete. However, in comparing the scope of the AP1000 D-RAP program with the previously approved AP600 D-RAP program, the staff noted several differences. For example, the AP1000 D-RAP included equipment, such as the CAS air compressor transmitter, the IRWST vents, and feedwater isolation valves, that was not included in the AP600 D-RAP program. Therefore, in RAI 260.002, the NRC staff requested additional information on the identification and prioritization of risk-significant SSCs within the scope of the D-RAP for the AP1000 design.

In the response to RAI 260.002, the applicant provided the NRC staff with a comprehensive list of differences between the risk achievement worth (RAW) and risk reduction worth (RRW) values for the AP600 and AP1000 design. The NRC staff reviewed the list of differences between the RAW and RRW between the two plants and found that it appropriately identified SSCs within the scope of the D-RAP for the AP1000 design. The NRC staff also reviewed information in the AP1000 PRA, Chapter 50, which contained all the RAW and RRW importance measure values for individual SSCs. This PRA information also was used to determine the list of risk-significant SSCs within the scope of the D-RAP.

## Quality Assurance

On the basis of the information noted above, the NRC staff found that the methodology used to identify SSCs included in the D-RAP in DCD Tier 2, Section 17.4.1, is consistent with the description of SSCs included in the D-RAP in SECY-95-132 and draft SRP Section 17.4. Therefore, RAI 260.002 is resolved.

In RAI 260.003, the NRC staff requested additional information on (1) the passive containment cooling and normal heat-removal functions that were added to the AP1000 design, (2) changes in I&C terminology in the AP1000 design, and (3) changes in the PCS recirculation motor-operated valves (MOVs) functions and valve position. The evaluation of the basis for these changes follows:

- Addition of PCS and Normal Residual Heat Removal Functions to the AP1000 Design

In DCD Tier 2, Section 17.4.1, the NRC staff identified two system functions that were added to the AP1000 D-RAP—(1) the PCS and MOV drain function for evaporative cooling of the containment shell during design-basis accidents, and (2) the RNS function. The NRC staff evaluated the changes in the risk ranking for these two functions and found that inclusion of these functions in the D-RAP for the AP1000 design was consistent with the applicant's D-RAP methodology.

- Changes in Instrumentation and Control Terminology

In the AP600 design, the scope of the D-RAP included the protection and monitoring system (PMS) actuation hardware, the ESF actuation, and protection logic cabinets. For the AP1000 design, the PMS actuation hardware, the ESF actuation, and protection logic cabinets were removed from the scope of the D-RAP. The NRC staff requested that the applicant provide additional information stating why it removed these cabinets from the scope of the D-RAP.

In a revision to DCD Tier 2, Section 17.4.1, the applicant added the PMS actuation hardware to incorporate changes in I&C system terminology that were made to DCD Tier 2, Chapter 7. Therefore, the scope of the hardware covered by the AP1000 D-RAP is acceptable.

- Changes in Passive Core Cooling System Containment Recirculation MOV Function and Normal Valve Position

In the AP600 design, the MOVs in the passive core cooling system recirculation lines have a safety function for automatic opening to provide core cooling. Because of the safety significance of this function, these MOVs were within the scope of the D-RAP for the AP600 design.

Although a previous revision of DCD Tier 2, Section 6.3.2.1.3, "Safety Injection During Loss of Coolant Accidents," indicates that the MOVs in each passive core cooling recirculation line automatically open to provide core cooling, the NRC staff found that these valves were not within the scope of the D-RAP for the AP1000 design.

In response to RAI 260.003c, the applicant issued a revision to DCD Tier 2, Section 6.3.2.1.3, to clarify that these MOVs are normally open and do not have a safety function to open automatically. On the basis of this change in the normal position of these valves, the NRC staff concludes that the applicant's determination that these passive core cooling MOVs do not need to be within the scope of the AP1000 D-RAP is acceptable.

In DCD Tier 1, Section 3.7, "Design Reliability Assurance Program," the staff found that the list of risk-significant components in the inspection, test analyses, and acceptance criteria (ITAAC) DCD Tier 1, Table 3.7-1, "Risk Significant Components," was not updated to include all risk-significant SSCs from the list of risk-significant SSCs identified in Tier 2, Table 17.4-1, "Risk-Significant SSCs within the Scope of D-RAP." Specifically, the list of risk-significant components in DCD Tier 1, Table 3.7-1 should include the following:

- compressed and instrument air system (CAS) air compressor transmitter
- passive containment cooling system (PCS) diverse third motor-operated drain isolation valve function
- in-containment refueling water storage tank (IRWST) vents
- normal residual heat removal (RNS) valve V055 function
- main feedwater isolation valves

As discussed in Section 17.4 of this report, the staff determined that DCD Tier 2, Table 17.4-1 contains an acceptable list of risk-significant SSCs under the scope of the D-RAP. In DCD Tier 2, Table 17.4-1, the applicant also removed the automatic open function of the safety-related passive core cooling condensate sump recirculation valves from the D-RAP for the AP1000 design; DCD Tier 1, Table 3.7-1 should reflect this. This was identified as DSER Open Item 14.3.2-15.

On July 8, 2003, Westinghouse provided the following response to Open Item 14.3.2-15. Westinghouse stated that on the basis of the review of DCD Tier 2, Table 17.4-1 and DCD Tier 1, Table 3.7-1, it had the following comments:

- The PRA importance of the CAS air compressor pressure transmitter had been reevaluated. Based on the current AP1000 PRA, this instrument just meets the D-RAP selection criteria (RAW, RRW) for large release frequency, although it does not meet the D-RAP selection criteria for core damage frequency. Furthermore, it has been determined that there are conservatisms in the PRA that have resulted in the overestimation of RAW/RRW values for this instrument. These conservatisms result from the failure to model some plant features that would have reduced the PRA importance of this instrument. Based on this reevaluation, the D-RAP tables in the DCD and the ITAAC should no longer list this instrument. Therefore, Westinghouse removed it from DCD Tier 2, Table 17.4-1 and has not added it to DCD Tier 1, Table 3.7-1.

## Quality Assurance

The NRC staff requested that Westinghouse add further information to this response concerning equipment that was not modeled in the PRA which would reduce the risk importance of the air compressor pressure transmitter. Westinghouse agreed to add information concerning instrument air bottles used to control air-operated valves in the feedwater system which would reduce the risk importance of the air compressor pressure transmitter.

- Westinghouse agreed to add the following equipment to DCD Tier 1, Table 3.7-1:
  - IRWST vents
  - main feedwater isolation valves
- Westinghouse stated that it does not need to add the third PCS water drain valve to DCD Tier 1, Table 3.7-1 because the valve already exists in the table. Three valves are listed under the passive containment cooling water storage tanks drain isolation valves (PCS-PL-V001A/B/C). The C valve is the diverse third drain valve.
- Westinghouse agreed that it should also add RNS valve V055 to the table. However, as indicated in DCD Tier 2, Section 17.4-1, the RNS also requires other RNS MOVs to allow it to provide RCS makeup following actuation of the automatic depressurization system (ADS), including the following:
  - V011 RNS discharge containment isolation
  - V022 RNS actuation containment isolation
  - V055 RNS suction from the spent fuel cooling system cask loading pit
  - V062 RNS suction from the in-containment refueling water storage tank
- Westinghouse agreed that it should remove the passive core cooling system containment recirculation MOVs (PXS-PL-V117A/B) from DCD Tier 1, Table 3.7-1, because they had been removed from DCD Tier 2, Table 17.4-1.
- The review by Westinghouse also indicated that it should make the following additional changes to DCD Tier 1, Table 3.7-1:
  - add chemical and volume control system makeup pump suction and discharge check valves
  - add inverters and battery chargers for the 24-hour batteries
  - add reactor vessel insulation water inlet and steam vent devices
  - add reactor cavity door damper
  - add service water cooling tower fans

- add low-capacity chilled water subsystem
- add standby diesel generator room cooling fans
- add fuel assemblies
- remove passive core cooling system valves PCS-PL-V125A/B from the in-containment refueling water storage tank injection squib valve group because these valves are not squibs, and V123A/B and V125A/B lists the four squibs in these lines

The NRC staff concluded that the Westinghouse response appropriately identified all risk-significant SSCs that should be within the scope of the D-RAP; however, the NRC staff noted that different equipment identification nomenclature between DCD Tier 2, Table 17.4-1, and DCD Tier 1, Table 3.7-1, made it difficult for the NRC staff to identify like components in each table. Westinghouse stated that it would add the risk-significant component tag number for each component to DCD Tier 2, Table 17.4-1 so that the nomenclature in the two tables is the same. In a revision to DCD Tier 2, Table 17.4-1, Westinghouse added the appropriate nomenclature to both tables. The NRC staff found this to be acceptable. Therefore, this part of Open Item 14.3.2-15 is resolved.

In addition, the NRC staff asked Westinghouse to verify that all of the risk-significant SSCs identified in DCD Tier 2, Table 17.4-1, match all of the risk-significant components in DCD Tier 1, Table 3.7-1. In a revision to DCD Tier 2, Table 17.4-1, and DCD Tier 1, Table 3.7-1, the NRC staff verified that the component lists in the two tables were identical. Therefore, this part of Open Item 14.3.2-15 is resolved.

The NRC staff also noted that Westinghouse needed to add the uninterruptible power supply (UPS) Distribution Panels, EDS1-EA-1 and EDS2-EA-1, to the AP1000 D-RAP. The NRC staff determined that these components have RAW values equivalent to UPS Distribution Panels EDS1-EA-14 and EDS2-EA-14. Therefore, the AP1000 D-RAP must include EDS1-EA-1 and EDS2-EA-1. In a revision to DCD Tier 1, Table 3.7-1, "Risk Significant Components," and Tier 2, Table 17.4-1, "Risk Significant SSCs Within the Scope of D-RAP," Westinghouse added UPS Distribution Panels EDS1-EA-1 and EDS2-EA-1 to the two tables. Therefore, this part of Open Item 14.3.2-15 is resolved. Therefore, Open Item 14.3.2-15 is resolved.

The NRC staff determined that the changes in the scope of equipment in the D-RAP for the AP1000 design is consistent with implementation of the D-RAP SSC identification and prioritization methodology in SECY-95-132 and draft SRP Section 17.4. Therefore, D-RAP Phase I activities are acceptable.

## Quality Assurance

### 17.4.7.2 D-RAP Phase II

- Development of Recommended Plant Maintenance and Monitoring Activities

In a previous revision of DCD Tier 2, Section 17.4.1, the applicant stated that the D-RAP, as shown in DCD Tier 2, Figure 17.4-1, is implemented in three phases. The first phase, design certification, defines the overall structure of the AP1000 D-RAP and implements the aspects of the program that apply to the design process. During this phase, risk-significant SSCs are identified for inclusion in the program by using probabilistic, deterministic, and other methods. Phase II, postdesign certification, develops component maintenance recommendations for the plant's operation and maintenance activities for identified SSCs. The third phase is the site-specific phase, which introduces the plant's site-specific SSCs to the D-RAP process. It is the applicant's position that the designer performs Phases I and II. The COL applicant is responsible for Phase III.

In a previous revision of DCD Tier 2, Section 17.4.7.2, "D-RAP Phase II," the applicant stated that "during Phase II of the D-RAP, maintenance assessments and recommendations are developed to enhance reliability of the plant risk-significant components."

In RAI 260.004, the NRC found that it is not appropriate for the applicant to state that it will complete Phase II, postdesign certification, following issuance of a design certification for the AP1000 design. The applicant should not have postdesign certification issues in the DCD for the AP1000 design. The design certification applicant or the COL applicant should complete this activity. The NRC asked the applicant to provide additional information to clarify the design certification applicant's or the COL applicant's additional responsibilities for completion of Phase II activities.

In a revision of DCD Tier 2, Section 17.4.1, the applicant revised paragraph 2 to state that, "Phase I is performed by the designer. Phases II and III are completed by the Combined License applicant." Westinghouse also revised DCD Tier 2, Section 17.4.6, paragraph 2, to state the following:

Development of maintenance assessments and recommendations for D-RAP (Phase II) and the site-specific portion of the D-RAP (Phase III) are the responsibility of the Combined License applicant. The Combined License applicant is responsible for submitting its maintenance recommendations (Phase II) and site specific (Phase III) D-RAP organization description to the NRC.

On the basis of this revised approach for maintenance recommendations on risk-significant SSCs, described in DCD Tier 2, Sections 17.4.1 and 17.4.7.2, and in accordance with the guidance in SECY-95-132 and the acceptance criteria in SRP 17.4, the NRC staff finds that the design certification applicant's approach for developing

recommended maintenance and monitoring activities is acceptable. On the basis of this revision to the DCD, RAI 261.004 is resolved.

- Dominant Failure Modes and Reliability and Availability Data

In RAI 260.005a, the NRC staff noted that DCD Tier 2, Section 17.4.7.2.1 did not clearly specify where the design certification application contained cross-reference information for the PRA assumptions for dominant failure modes and for reliability and availability data. The NRC staff asked Westinghouse to add the cross-references in DCD Tier 2, Section 17.4.7.2.1. In a revision of DCD Tier 2, Section 17.4.7.2.1, Westinghouse added the appropriate cross-references as noted on each of the three items listed below. In a revision to DCD Tier 2, Section 17.4.7.2.1, Westinghouse stated that to support the COL applicant's D-RAP Phase II and Phase III and O-RAP, it will provide the following information:

- the list of risk-significant SSCs identified during the design phase (DCD Tier 2, Table 17.4-1)
- the PRA assumptions for component unavailability and failure data (Chapter 32 of the AP1000 PRA)
- the analyses performed for components identified as major contributors to total risk, with dominant failure modes identified and prioritized (major contributors to total risk identified in Chapter 50 of the AP1000 PRA, and the analyses of the respective systems and associated components in DCD Tier 2, Table 17.4-1 described in Chapters 8 and 20 of the AP1000 PRA; suggested means and prevention or mitigation of these failure modes that form the basis for the plant surveillance, testing, and maintenance programs)

The NRC staff finds that the references noted in DCD Tier 2, Sections 17.4.7.2 and 17.4.7.2.1, for D-RAP Phase II meet the guidance in SECY-95-132 and the acceptance criteria in draft SRP Section 17.4. Therefore, D-RAP Phase II activities are acceptable, and RAI 260.005a is resolved. This is also a COL action item in Section 17.5 of this report.

#### 17.4.7.3 D-RAP Phase III

In DCD Tier 2, Section 17.4.7.3, Westinghouse stated the following:

Site specific activities of the D-RAP are the responsibility of the Combined License applicant. [DCD Tier 2,] Figure 17.4-1 shows these activities in the Phase III area of the figure. At this stage, the D-RAP package is modified or appended based on considerations specific to the site.

## Quality Assurance

The COL applicant will need to establish the PRA importance measures, the expert panel process, and other deterministic methods to determine the site-specific list of SSCs under the scope of RAP.

The Combined License applicant would benefit from using the Phase I and II processes as a guide during this phase of the program. It is the responsibility of the Combined License applicant to ensure its Expert Panel is composed of personnel knowledgeable in the systems, operations, and maintenance of a plant, and that these personnel should have the breadth of experience necessary to perform the site-specific SSC selections and evaluations for the RAP.

On the basis of the above, the NRC staff agreed that D-RAP Phase III is appropriately identified as a COL applicant activity. This is a COL action item in Section 17.5 of this report. This activity also meets the guidance in SECY-95-132 and the draft SRP Section 17.4. Therefore, DCD Tier 2, Section 17.4.7.3, is acceptable.

### 17.4.7.4 D-RAP Implementation

In a revision of DCD Tier 2, Section 17.4.7.4, "D-RAP Implementation," Westinghouse stated the following:

The following is an example of a system that was reviewed and modified under the D-RAP, Phase I and II. The design and analytical results presented here are intended as an example and do not reflect the current AP1000 design.

In DCD Tier 2, Section 17.4.7.4, Westinghouse provided an example of D-RAP implementation using the ADS as a selection of components that are in the D-RAP for the AP1000 design. In RAI 260.005b, the NRC staff determined that the wording in the second sentence of the first paragraph in DCD Tier 2, Section 17.4.7.4, was confusing. In a revision to DCD Tier 2, Section 17.4.7.4, Westinghouse revised the paragraph to state the following:

The following is an example of a system that was reviewed and modified under the D-RAP, Phase I. The design and analytical results presented here are intended as an example.

The NRC staff finds that this change is acceptable. The NRC staff also finds that the ADS example is appropriate for the AP1000 implementation of the D-RAP. Therefore, DCD Tier 2, Section 17.4.7.4, is acceptable, and RAI 260.005b is resolved.

### 17.4.8 **Glossary of Terms**

In DCD Tier 2, Section 17.4.8, "Glossary of Terms," Westinghouse added the abbreviation "RTNSS" to the list. The NRC staff determined that this section contained all the necessary and appropriate terms used in the D-RAP. Therefore, DCD Tier 2, Section 17.4.8 is acceptable.

#### **17.4.9 Conclusions**

On the basis of the NRC staff's review and evaluation of DCD Tier 2, Section 17.4, the NRC staff concludes that the D-RAP for design certification of the AP1000 design is consistent with the guidance provided in SECY-95-132 and draft SRP Section 17.4. Therefore, the D-RAP is acceptable.

#### **17.5 Combined License Information Items**

In an effort to ensure that the COL applicant accomplishes the COL action items identified in DCD Tier 2, Section 17.5 and associated with the D-RAP and O-RAP, in a manner consistent with the guidance in SECY-95-132, the NRC asked the applicant to provide a COL action item to reflect conformance with SECY-95-132 guidance. This was identified as DSER Open Item 17.5-1.

In a revision to DCD Tier 2, Section 17.5, Westinghouse added the following:

This program will address failures of non-safety-related, risk-significant SSCs that result from design and operational errors in accordance with SECY-95-132, Item E.

On the basis of the information in revised DCD Tier 2, Section 17.5, DSER Open Item 17.5-1 is resolved.

In DCD Tier 2, Section 17.5, "Combined License Information Items," Westinghouse describes the following COL action items (note that the NRC staff action item number follows each Westinghouse item):

The Combined License applicant or holder will address its design phase Quality Assurance program, as well as its Quality Assurance program for procurement, fabrication, installation, construction, and testing of structures, systems and components in the facility. The Quality Assurance program will include provisions for seismic Category II structures, systems and components. This is COL Action Item 17.5-1.

The COL applicant or holder will establish PRA importance measures, the expert panel process, and the other deterministic methods to determine the site-specific list of SSCs under the scope of RAP. This is COL Action Item 17.5-2.

The Combined License applicant is responsible for integrating the objectives of the O-RAP into the Quality Assurance Program developed to implement 10 CFR [Part] 50, Appendix B. This program will address failures of non-safety-related, risk-significant SSCs that result from design and operational errors in accordance with SECY-95-132, Item E. This is COL Action Item 17.5-3.

## Quality Assurance

The Combined License applicant or holder will address its Quality Assurance program for operations. This is COL Action Item 17.5-4.

The following activities are represented in [DCD Tier 2,] Figure 17.4-1 as “Plant Maintenance Program.”

The Combined License applicant is responsible for performing the tasks necessary to maintain the reliability of risk-significant SSCs. Reference 8 [Lofgren, E.V., Cooper, et al., “A Process for Risk-Focused Maintenance,” NUREG/CR-5695, March 1991] contains examples of cost-effective maintenance enhancements, such as condition monitoring and shifting time-directed maintenance to condition-directed maintenance.

The Maintenance Rule (10 CFR 50.65) is relevant to the Combined License applicant’s maintenance activities in that it prescribes SSC performance-related goals during plant operation. This is COL Action Item 17.5-5.

In addition to performing the specific tasks necessary to maintain SSC reliability at its required level, the O-RAP activities include:

- Reliability data base—Historical data available on equipment performance. The compilation and reduction of this data provides the plant with source of component reliability information.
- Surveillance and testing—In addition to maintaining the performance of the components necessary for plant operations, surveillance and testing provides a high degree of reliability for the safety-related SSCs.
- Maintenance plan—This plan describes the nature and frequency of maintenance activities to be performed on plant equipment. The plan includes the selected SSCs identified in the D-RAP.

This is COL Action Item 17.5-6.