March 17, 2009

MEMORANDUM TO: Eileen McKenna, Chief
AP1000 Projects Branch 2
Division of New Reactor Licensing
Office of New Reactors

FROM: Christopher Proctor, Project Manager
AP1000 Projects Branch 2 ***/RA/***
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: NRC ON-SITE REVIEW OF THE INTEGRATION OF REGULATORY TREATMENT OF NON-SAFETY SYSTEMS WITH CLASSIFICATION PROCESS AND CHAPTER 19 FSER OPEN ITEMS IN AP1000 (DOCKET NO. 52-006)

As part of the review of the Westinghouse AP1000 design certification amendment request, members of the U.S. Nuclear Regulatory Commission (NRC) staff performed an on-site review at the headquarters of the Westinghouse Electric Company in Monroeville, Pennsylvania from February 17 - 18, 2009. The NRC staff review team comprised personnel from the Division of Engineering, the Division of Safety Systems and Risk Assessment, and the Division of New Reactor Licensing.

Enclosed is the combined EMB and SPLA report summarizing the on-site review. The NRC expects that Westinghouse will make corrections to their design documents that will consider NRC observations identified in this report. The NRC staff plans a subsequent review of classification and detailed design basis documents once they are made available by Westinghouse at their Rockville, MD office.

Enclosures:
1. On-site Review of the Integration of Regulatory Treatment of Non-Safety Systems with Classification Process
2. On-Site SPLA Input Review of DCD Chapter 19 Open Items
3. On-Site Review: Meeting Attendance
4. On-Site Review: List of Documents Reviewed
5. Slide Presentation: AP1000 Documentation and Implementation of Regulatory Treatment of Non-Safety Systems

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ADAMS ACCESSION NUMBER**: ML090640216 (PKG)**

OFFICE	LA:DNRL:NWE2:NRO	PM:DNRL:NWE2:NRO	BC:DE:EMB2:NRO	BC:DSRA:SPLA:NRO	BC:DNRL:NWE2:NRO
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On-site Review of the Integration of Regulatory Treatment of Non-Safety Systems with Classification Process

Purpose of On-Site Review

The primary purpose of this on-site review was to establish the extent that the applicant had integrated regulatory treatment of non-safety systems (RTNSS) with the classification process in order to resolve open items (OIs) associated with the review of AP1000 Amendment 16. A secondary purpose was to review a sampling of detailed design basis documents to determine the extent that these documents correctly reflect design certification document (DCD) information and regulatory requirements. This on-site review was related to a proposed NRC interim staff guidance (ISG) to evaluate design areas that were not sufficiently mature at the time of initial design certification.

Before the on-site review, the NRC staff asked Westinghouse to provide the resources and documents listed in Attachment 1.

Scope of the Review

The following topics were discussed by the applicant's staff:

- RTNSS, design reliability assurance program (D-RAP), and classification processes
- status of WCAPs related to RTNSS and quality assurance (QA)
- system, structure, and component (SSCs) needed for continued operation following operating-basis earthquake (OBE)
- inspection, test, analyses, and acceptance criteria ITAAC for seismic Category II and RTNSS SSCs (D-RAP SSCs)
- Tier 2* items (RTNSS, seismic Category II)
- exceptions to Regulatory (RG) 1.29 for seismic Category II reactor internals
- sample applied to nondestructive examination (NDE) of NRC Quality Group
- (QG) C items with augmented NDE (Pressurizer)

Documents

The staff reviewed detailed design documents that identify procurement requirements and the classification of each SSC documented in the DCD. This included:

- piping and instrument drawings (P&IDs)
- design specifications
- procurement specifications
- data sheets
- engineering evaluations

In addition, the staff reviewed reports from the applicant's corrective action program and other documents related to requests for additional information (RAI) that have not yet been closed.

Open Items to be Resolved

- augmented seismic requirements for RTNSS SSCs
- completeness in scope
- augmented QA for seismic Category II SSCs
- supplemental requirements for passive SSCs important to safety

Summary of Review

NRC Staff met with Westinghouse staff at their office in Monroeville, PA. This was the first on-site review of the AP1000 classification process by DE/EMB staff. Westinghouse staff provided a brief overview of the classification process and summary of RTNSS information which is included as Attachment 2. Westinghouse confirmed that the RTNSS SSCs described in WCAP-15985, Revision 2 was reviewed as part of the AP1000 design certification final safety evaluation report (FSER) Chapter 22 and that other documents that have not been submitted to the NRC describe the D-RAP quality system requirements and QA requirements for RTNSS SSCs. After the introductory pre-review meeting, the NRC DE/EMB and SPLA staff discussed the detailed design classification and RTNSS processes separately with members of the Westinghouse teams responsible for these processes.

Classification Process

The NRC classification team met with Westinghouse personnel involved with AP1000 licensing, system engineers, piping engineers and the RTNSS process. Prior to the meeting, NRC Staff had requested specific types of design basis documents be available for the classification review, but only limited information was available for review. Two important design documents associated with RTNSS and the D-RAP were available for review, but these were not docketed information and time did not permit a detailed review of these documents.

Westinghouse personnel were able to answer some NRC questions to clarify their position on exceptions to regulatory guidance and special treatment, but documentation of those positions and design requirements in detailed design documents was not sufficient for staff to close open items identified in the staff review of design certification (DC) Amendment 16 or to demonstrate that design requirements concerning classifications and special treatment have been adequately translated into design documents.

In response to NRC staff concerns and questions, the following information and verbal responses were provided by Westinghouse personnel to demonstrate how the classification process is translated into the detailed design and to clarify their positions on the classification of certain important to safety SSCs to, in part, satisfy General Design Criteria 1 and 2.

Review of P&IDS and SSDs

Only simplified drawings are included in the DCD, but the full-size, detailed P&IDs should clearly identify the classification of systems and components. P&IDs are considered by Westinghouse to represent the highest tier of detailed design information relative to classifications. The P&ID drawings requested were not available for staff review on the first day, but examples were provided on the second. The versions of P&ID documents available for review are included in Enclosure 3, but staff did not perform a detailed review of these documents. Staff determined that the P&ID drawings do show the piping class, which documents the safety class and quality group by the last letter. Classification boundaries typically occur at valves. Underground piping was shown on the P&IDs and Westinghouse clarified that non-metallic piping is only used in limited buried applications in the service water and component cooling water systems.

As identified in the DCD and TR-103, nonmetallic piping is permitted by the applicable B31.1 Code where determined acceptable by an engineering evaluation. A documented engineering evaluation was not available for review, but for risk-significant systems, NRC staff believes this engineering evaluation should be documented.

Seismic classification boundaries are not identified on the P&ID drawings but are included on the system specification documents (SSDs). A sample of the service water SSD was shown to NRC staff, but it appeared that these SSDs have not been updated and will require changes to reflect the RTNSS process in regard to classifications and QA treatment. Westinghouse recognizes that this will be accomplished in a Phase 3 update of the SSDs. Westinghouse should notify the NRC when this phase is expected to be complete.

Review of RTNSS and D-RAP Design Documents

APP-GW-GRR-009 and APP-GW-GAM-200 are key design documents that were prepared after the DCD was certified to identify appropriate supplemental QA requirements applicable to D-RAP and RTNSS SSCs. These documents are not on the docket and Westinghouse does not plan to issue these as topical reports. There was not sufficient time for NRC staff to perform a detailed review, but Westinghouse indicated that these documents will be made available at their Rockville, Maryland office to further NRC review. Other NRC reviewers that review QA and special treatment for RTNSS may also be interested in these documents.

Augmented NDE for Exceptions to RG 1.26

Details of the random sample to be used for the examination of the PCCS piping and equipment that is classified as an exception to RG 1.26 (as Safety Class C (QG C) with augmented NDE rather than QG B) are not available at this time. Westinghouse does plan to include augmented ISI in addition to the augmented NDE on fabrication and construction welds.

Once the details of the random sampling approach are developed, Westinghouse should notify the NRC.

Exception to RG 1.29 for Non-Safety-Related Reactor Internals

RG 1.29 identifies that reactor pressure vessel (RPV) internals should be seismic Category I. Although Westinghouse did not identify an exception to RG 1.29 relative to the categorization of RPV internals, certain non-safety-related components within the RPV are identified as seismic Category II rather than seismic Category I. Westinghouse believes that the analysis as seismic Category I will ensure that they are designed to withstand earthquakes and seismic Category I classification is not needed. This position should be acceptable for non-safety-related SSCs, but this exception to RG 1.29 should be identified and justified in the DCD.

List of SSCs Designed for Continued Operation after an OBE

Westinghouse contends that since OBE does not apply to the design of the AP1000, a list of SSCs designed for the OBE is not needed. They also contend that the SRP identifying this list of SSCs does not apply to their DC.

ITAAC for Seismic Category II SSCs

Westinghouse personnel identified that ITAAC do exist for appropriate seismic Category II SSCs that are considered important to safety. Several examples were identified and a process is in place to identify system interactions that may identify additional SSCs that may need to be seismic Category II. The applicant does not consider Tier 2* items are needed for seismic Category II SSCs.

Augmented Seismic Requirements for RTNSS SSCs

This concern was identified as an open item during the EMB review of Section 3.2 of the amended DCD (Revision 16). Westinghouse does not consider that RTNSS SSCs need any seismic requirements other than certain risk-significant RTNSS components have seismic anchorage and are located in a seismic Category II structure, as identified in the DCD. Also, other RTNSS SSCs reference building codes that may not be appropriate for the seismic qualification of components. The basis for this requirement is SECY-95-132. Staff is concerned that these seismic requirements do not assure functionality of the RTNSS SSCs such as the ancillary diesel generators added in Amendment 17 so that they will be operable after an earthquake.

Completeness in Scope

This concern was identified as an open item during the EMB review of Section 3.2 of the amended DCD (Revision 16). Westinghouse recognizes that certain SSCs may have been omitted from the DCD classification Tables in 3.2 for seismic classification and that the DCD may need to be updated as the detailed design progresses.

Quality Requirements for Seismic Category II SSCs

This concern was identified as an open item during the EMB review of Section 3.2 of the amended DCD (Revision 16). The QA applicable to the design of seismic Category II SSCs is limited to the analysis of these SSCs rather than the entire QA provisions of 10 CFR 50 Appendix B. To this extent, the applicant contends that they fulfill the pertinent sections of 10 CFR 50 Appendix B in order to comply with RG 1.29. This position should be acceptable provided the DCD clarifies and justifies the extent that 10 CFR 50 Appendix B is applied to SSCs that are seismically classified.

Supplemental Requirements for Passive SSCs Important to Safety

This concern was identified as an open item during the EMB review of Section 3.2 of the amended DCD (Revision 16). Westinghouse clarified that there are a few examples of passive SSCs included as RTNSS SSCs, but in general passive SSCs are excluded on the basis of screening criteria supported by operating experience. The reference documents that identify QA requirements for RTNSS and supplemental QA requirements for enhanced reliability in the D-RAP should be further reviewed by NRC staff to determine appropriate treatment for risk-significant SSCs.

Conclusion

At the exit meeting NRC staff summarized their review and basic findings that require follow-up actions. In general, staff found the on-site review helpful to better understand how the classification and RTNSS processes are integrated and how requirements are implemented in

the detailed design. The Westinghouse staff was able to satisfactorily answer most staff questions in the areas of classification and RTNSS. However, NRC staff found that available design documentation was inadequate to close the open items on the classification process and the complete design basis documents requested were either not available for review or needed to be updated to better reflect the classification of SSCs and the RTNSS process. Staff recommended that, to support future on-site reviews, Westinghouse should be better prepared so that the on-site review can be conducted in an efficient manner. Specifically, all design basis documents regarding classifications should be readily available for NRC review either in paper form or electronically such that NRC has full access to the document.

It was also recommended that the NRC Open Items be better communicated from the project manager to Westinghouse and that documents that are not to be docketed be available for NRC review at the Westinghouse Rockville office.

Attachment 1

Engineers knowledgeable in the areas of classification and regulatory treatment of non-safety systems (RTNSS) processes should be available to discuss the staff's concerns. Documentation to clarify the classification process should be made available for review (could include design specification, procurement specification, engineering evaluation, quality assurance (QA) program description, Q-List, etc.). Structures, systems and components (SSCs) of interest include:

- ancillary diesel generators
- passive containment cooling system (PCS) (AP1000) recirculation pumps
- main control room (MCR) and instrumentation and control (I&C) ancillary fans
- service water pumps
- RTNSS electrical equipment
- post accident instrumentation
- reactor pressure vessel (RPV) insulation
- plant-specific SSCs
- radwaste building
- annex building
- ancillary diesel generator fuel tank
- service water system non-metallic piping
- service water cooling tower
- component cooling water heat exchangers
- hydrogen igniters
- vacuum breaker valves

To further assist in completing the safety evaluation report (SER), piping and instrumentation drawings (P&IDs) (if available) for the following systems/components can be made available to allow the staff to make the conclusion that equipment important to safety have been appropriately identified (from a classification standpoint) on P&IDs:

- reactor coolant system
- passive core cooling system
- electrical distribution system
- service water system
- component cooling water system
- fire protection system
- liquid radwaste system
- circulating water system

Attachment 2

Slides from Westinghouse Overview of the Classification Process and RTNSS in AP1000

- *AP1000 Documentation and Implementation of RTNSS* (ML090650149)
- *Mechanical Equipment Design Specifications for Reliability Assurance Program* (ML090650130)

On-Site SPLA Input Review of DCD Chapter 19 Open Items

The NRC staff is assembling a draft supplement to NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design." There are ten open items in Chapter 19, "Severe Accidents," that the staff has identified to date. Members of the on-site review team reviewed each of them with members of the applicant's staff.

Open item OI-SRP19.0-SPLA-05 requests that Westinghouse confirm that review of previously screened design change packages (DCP) has been documented. DCPs are to be reviewed for risk implications resulting from changes that do not alter stress-corrosion cracking (SSCs) modeled in the probabilistic risk assessment PRA (e.g., changes to procedures) yet challenge assumptions and insights from the PRA. During the review, the staff learned Westinghouse has already reviewed DCPs with the potential to alter SSCs that are modeled in the PRA. They have amended these procedures to document review of all DCPs for Revision 17 to the AP1000 DCD. They understand that review of DCPs for Revision 16 that were not addressed in TR-135 must also be completed. Westinghouse will submit a new revision to the RAI-SRP 19.0-SPLA-05 response committing to complete the review prior to initial fuel load. The staff already reviewed the process that has been used to capture most of the potential effects of design changes (on the PRA and the severe accident analysis). The staff agrees that this process has provided an acceptable basis for licensing and that the completion of reviews for Revision 16 may be deferred so long as they are completed prior to initial fuel loading.

Open item OI-SRP19.0-SPLA-07 concerns implementation of corrective action post audit, resolving and re-quantifying the corrected model as well as revising TR-102 and making associated changes to the DCD consistent with COL/DC-ISG-3. During the on site review, Westinghouse provided documentation showing that re-solving the model is no longer a separate step in the quantification process. The staff understands that the results of the reported requantification are a suitable basis for responding to this RAI. It is the staff's position that the requested information is required to satisfy 10CFR52.47(a)(27). If TR-102 is revised to show that this information will be added to the DCD, this open item will be replaced with a confirmatory item until the DCD is revised and accepted.

The staff also reviewed the corrective action program (CAP) reports associated with the discrepancy that had given rise to this RAI. The discrepancy is described in an earlier audit report [ML083230705]. The CAP reports document appropriate actions to determine the extent of the condition, correct all discrepancies identified, identify the causes of the problem, and prevent recurrence. Westinghouse closed the CAP item. The handling of the discrepancy is acceptable to the staff.

Open item OI-SRP19.0-SPLA-08 asks Westinghouse to identify compensatory measures to be taken when maintenance activities may disable instrumentation used for the detection of flooding. During the review, Westinghouse committed to submit a new revision to RAI-SRP19.0-SPLA-08 response that will address what, if any, compensatory measures will be taken when maintenance activities disable instrumentation used for the detection of flooding.

Open item OI-SRP19.0-SPLA-12 asks Westinghouse to confirm that an acceptable seismic margin is maintained for hard-rock high-frequency (HRHF) sites. After discussing the issue, Westinghouse has agreed to either provide a technical explanation to justify a smaller seismic margin or show that there is in fact significant margin as defined by NRC regulatory guidance. This will be submitted in a revision to RAI-SRP19.0-SPLA-12 response.

Open Item OI-SRP19.0-SPLA-13 request that Westinghouse provide a revised DCD description of the sequences contributing most to shutdown risk. It is the staff's position that the requested information is required to satisfy 10CFR52.47 (a)(27). During the on site review, the staff agreed that if TR102 is revised to show that this information will be added to the DCD, this open item will be replaced with a confirmatory item until the DCD is revised and accepted.

Open item OI-SRP19.0-SPLA-14 seeks to resolve the discrepancy in the containment inventory of radionuclides used for survivability evaluation and to determine whether mechanical penetrations and hatches (e.g., gasket materials) need to be included in the survivability assessment. It also requests that the applicant provide a holder item to finalize the list of equipment that must survive. During the onsite review, Westinghouse agreed to submit a revision to RAI-SRP19.0-SPLA-14 response to clarify the basis for dose reductions. An additional on-site review of the survivability assessment will be scheduled as soon as possible.

During the discussion of OI-SRP19.0-SPLA-14, the staff also identified an additional information requirement. Specifically, 10 CFR 50.44(c)(4)(ii) states that equipment must be functional, reliable, and capable of continuously measuring the concentration of hydrogen in the containment atmosphere. Late in the severe accident sequence, it is not clear that this can be accomplished with monitors inside containment. If this is not demonstrated, additional monitoring equipment outside containment must be identified and its survivability confirmed. An RAI will be transmitted separately.

Open item OI-SRP19.0-SPLA-17 requests the applicant confirm that the bounding case for toxic material hazard has been addressed in the DCD or provide an associated COL information item. In the course of the review, Westinghouse presented a draft response to RAI-SRP19.0-SPLA-17 to show that the risk from release of toxic material is negligible at any credible frequency. Westinghouse also agreed to include in the response a comprehensive list of potential external events considered. For those that are not addressed in the PRA the basis for screening them from the assessment will be documented.

Open Item OI-SRP19.0-SPLA-18 requests that the applicant address the case of high winds while in MODE 5 and 6, either to screen it from consideration or to quantify the associated risk. During the on site review, Westinghouse agreed to respond to RAI-SRP19.0-SPLA-18 with evidence that procedures cover actions in hurricane conditions. Similar procedures will also be provided for tornadoes and any other high wind events.

Open item OI-SRP19F-SPLA-01 is related to the review of malevolent aircraft impact. The applicant need not take any further action on this issue at this time. The applicable rule was issued on February 18, 2009. The staff will request additional information if needed to complete its review of this topic.

Open item OI-TR24-SPLA-06 asks that the applicant establish a COL holder item or inspection, test, analyses, and acceptance criteria (ITAAC) to confirm the removal of temporary coatings on the reactor vessel. During the on site review, Westinghouse agreed to submit a revision to RAI-TR24-SPLA-06 response to commit to creating an ITAAC or COL holder item that addresses removal of temporary coatings on the reactor vessel.

On-Site Review: Meeting Attendance

Name	Organization	Phone
Jennifer Dixon-Herrity	NRC/NRO/DE	(301) 415-2967
Yuken Wong	NRC/NRO/DE	(301) 415-0500
Richard McNally	NRC/NRO/DE	(301) 415-4006
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Dan Frederick	W AP1000 Aux. Equip.	(412) 374-4503
Jim Moon	W AP1000 Aux. Equip.	(412) 374-4336
Dave Kitch	W AP1000 Aux. Equip.	(412) 374-4392
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D.A. Lindgren	W AP1000 Licensing	(412) 374-4856
Thom Ray	W AP1000 Licensing	(412) 374-5309
Mathew Evans	W AP1000 NSE	(412) 374-3750
Rob Sisk	W NRO/Licensing	(412) 374-6206
Steve Kopelic	W NS- PRA	(412) 374-3340
John Kitzmiller	W NS RAM I (PRA)	(412) 374-4135
Rick Anderson	W NS RAM-I (PRA)	(412) 374-4135
Damian Mirizio	W RAM I	(412) 374-3494

On-Site Review: List of Documents Reviewed

1. APP-ECS-E3-003, Rev. A, Ancillary Diesel Generator One Line Diagram
2. APP-SWS-M6-001, Rev. 2, Service Water System P&ID
3. APP-ECS-E3-001, Rev. B, AC Power System Station One Line Diagram
4. APP-ECS-E3-002, Rev. B, AC Power System Station One Line Diagram
5. APP-CCS-M6-001, Rev. 3, Component Cooling Water System P&ID
6. APP-FPS-M6-001, Rev. 0, Fire Protection System P&ID
7. APP-FPS-M6-002, Rev. 1, Fire Protection System P&ID
8. APP-RCS-M6-001, Rev. 7, Reactor Coolant System P&ID
9. APP-PXS-M6-001, Rev. 2, Passive Core Cooling System P&ID
10. APP-WLS-M6-001, Rev. 1, Liquid Radwaste System P&ID
11. APP-GW-GAM-200, Rev. 1, AP1000 Quality Assurance Requirement for RTNSS Systems, Structures and Components
12. APP-GW-GRR-009, Rev. 1, AP1000 Design Reliability Assurance Program
13. APP-MP10-Z0-001, Rev. 1, Non-Safety Horizontal Single Stage Non-ANSI Centrifugal Pumps
14. APP-MP06-Z0-001, Rev. 1, CVS Makeup Pump Design Specification
15. APP-MP06-ZOR-001, Rev. 0, CVS Makeup Pump Datasheet Report
16. APP-PV54-ZOR-001, Rev. 0, Three-Way Valves, ASME B16.34 Valve Data Sheet Report
17. APP-PRA-GSC-236, “AP1000 PRA Quantification,” (initial issue)
18. Reports from the corrective action program related to RAI-SRP19.0-SPLA-07:
    - 08-129-M008.01 Apparent Cause Analysis/Correction
    - 08-129-M008.02–04 Cause forms
    - 08-129-M008.02–06 Commitment forms
    - 08-129-M008 Issue Report dated December 10, 2008