

AP1000 Design Control Document Changes Since Revision 18 (October 7, 2011)

Introduction

This enclosure discusses changes that were made to the design control document (DCD) and the rule since submittal of Revision 18 and publication of the proposed rule for comment. The U.S. Nuclear Regulatory Commission (NRC) staff's review of Revision 18 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML103260072),¹ identified a few areas where the DCD wording should be revised for clarity, to resolve internal inconsistencies, or to provide updated versions of referenced technical reports. In addition, three technical issues were noted: a load combination for the shield building, the method used to evaluate tank sloshing, and containment peak pressure analysis error correction. As a result of these activities, Westinghouse Electric, LLC (Westinghouse) submitted Revision 19 of the DCD on June 13, 2011 (ADAMS Accession No. ML11171A315), and Revision 19 is the version of the DCD that will be certified. The staff has determined that none of the changes from Revision 18 to Revision 19 of the DCD require an additional opportunity for public comment. These changes, which are organized into five subject areas, are discussed below.

In its review of Revision 19, the NRC also determined that three of the five subject areas should be identified as Tier 2* matters in the Section VIII, "Finding of No Significant Environmental Impact: Availability," in the statement of consideration of the final rule. The staff further determined that none of these three new Tier 2* designations in Section VIII.B.6 of the final rule language require an additional opportunity for public comment.

DCD Structural Design Information and Shield Building Tier 2* Information

Revision 18 of the DCD moved some design details about structures, including the shield building, from supporting Westinghouse documents into the DCD itself. Some of the details were marked as Tier 2*, based upon initial NRC staff comments. For example, information about penetrations was brought out of TR-9 into the DCD, and the shield building structural description was added to Section 3.8.4 in Revision 18.

The advanced final safety evaluation report (AFSER) included a confirmatory item to verify that the DCD appropriately reflected all necessary details about the structural design and shield building, and clearly showed which design details were to be Tier 2* (see AFSER Section 3.8.4 under ADAMS Accession No. ML103430502). The staff was able to close the confirmatory item after Westinghouse submitted Revision 19 of the DCD, by verifying the appropriate structural details were in the DCD and the design details were identified as Tier 2*. These DCD revisions enhanced the description of the design and were not a result of changes to the design itself. Westinghouse Report GLR-603, submitted on March 28, 2011 (ADAMS Accession No. ML110910541), was the nonproprietary version of the report that presented shield building information to be made Tier 2* (those aspects that were also proprietary), in addition to the DCD information added to Section 3.8 and Appendix 3H. The scope of the report was materials, connection details, and tie bar spacing.

¹ This is the ADAMS package number that collected all chapters. Chapters of the AFSER were individually issued as ADAMS documents. Chapter 3 is under ADAMS Accession No. ML103430502. The chapters are also posted on NRC's public Web site under Design Certifications, AP1000 Amendment.

Use of steel composite modules was the heart of the revised shield building design, including the the NRC determination that existing consensus standards are not technically applicable in all respects to analysis of the composite modules. This was a key factor in the NRC conclusion that design details about the shield building are Tier 2*, so that any future changes to that information by the combined license (COL) would receive prior staff review and approval. The staff considered the existing rule language as it relates to Tier 2* designation for structural information. For example, the existing rule includes use of ACI-349, definition of critical locations and thicknesses, nuclear island structural dimensions, and design summary of critical sections. Some of the critical sections are within the shield building, and ACI-349 was part of the design criteria. However, the staff concluded, during the course of final rule preparation, that the rule would be more clear if the use of steel composite module details that are designated in the DCD as Tier 2* was explicitly stated in the final rule (at Section VIII.B6(c)). As a result of the Tier 2* markings, a conforming change is being made to the final rule language to Section VIII.B.6(c) about the categories of Tier 2* information that would expire at fuel load.

The NRC does not believe that the DCD changes or the designation of this information as Tier 2* in the final rule require renoticing because the material was publicly available in referenced reports, the staff's intention was clear with the confirmatory item, and there were no comments regarding the extent of Tier 2* inclusion in Revision 18.

Implementation of Revision 18 Commitments for the Shield Building

Load Combinations for Shield Building

In the followup to an apparent editorial error in a table in the shield building report, the staff determined that Westinghouse had not documented in its calculations the numerical combination of the loads for external temperature conditions (minus 40 degrees F) and a safe-shutdown earthquake (SSE). On April 12, 2011, the NRC asked Westinghouse to document in the shield building report the numerical combination of loads for extreme ambient thermal loads and SSE loads as specified in DCD Table 3.8.4-1 for steel structures and Table 3.8.4-2 for concrete structure (see meeting summary dated May 17, 2011 (ADAMS Accession No. ML111440298)). By letter dated July 14, 2011, Westinghouse responded to this request (ADAMS Accession No. ML111950098), and concluded that the current design is acceptable when the load combinations are explicitly analyzed. The analysis results are discussed in detail in Revision 4 of the shield building report. Changes were made to the DCD to reflect the results of this load combination analysis, but the changes did not involve any changes to the methodology or the design of the shield building. The specific DCD changes were the addition of Section 3.8.4.5.5 to discuss the load combination analysis and updating of tables of results in Appendix 3H. No change to the language of the AP1000 design certification rule (DCR) in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, Appendix D was made as a result of the DCD changes.

The staff does not believe these DCD changes require renoticing because Revision 18 of the DCD stated that the design would be verified using the required load combinations, and these load combinations had previously been approved by the NRC for use in AP1000 analyses similar to those for the shield building elements requiring reanalysis. There was no change to the methodology or the actual design of the shield building was needed, and there was no change to the language of the AP1000 DCR. The NRC notes that on the June 16, 2011, "petition" (filed by John Runkle) that requested the NRC terminate the rulemaking specifically

raised the three technical issues in Revision 19, including the load combination topic.

Passive Containment Cooling Water Storage Tank

During the analysis of the thermal plus earthquake load combination for the passive containment cooling water storage tank (located on top of the shield building). Westinghouse determined that they had not performed analysis of hydrodynamic loads using an equivalent static analysis as stated in Westinghouse's response (ADAMS Accession No. ML102650101) to an action item from the NRC's shield building report review (documented in AFSER Chapter 3 (ADAMS Accession No. ML103430502)). Instead, the analyses had been done by response spectrum analysis. Both the equivalent static method and the response spectrum method had previously been approved by the NRC for use in the AP1000 design for structural analyses as described in Revision 18 of the DCD. This issue was discussed in a May 17, 2011, public meeting (see meeting summary dated May 26, 2011 (ADAMS Accession No. ML111430775)). In response, Westinghouse performed the analysis with this method and presented the results in the revised shield building report and in DCD Revision 19 as follows. The use of the equivalent static method for the tank is discussed in Section 3.7 and Appendix 3G, and a table and figure were added to Appendix 3H. The revised shield building report included the results of the load combination for the containment cooling water storage tank using, the equivalent static analytical methods, which demonstrated that the design remained adequate when evaluated using the equivalent static analytical method. No change to the language of the AP1000 DCR in 10 CFR Part 52, Appendix D was made as a result of the DCD changes.

The staff does not believe these DCD changes require renoticing. Revision 18 of the DCD stated that the design would be verified through the use of the equivalent static method, and that method had been previously approved by the NRC for AP1000 analyses equivalent to that performed for the containment cooling water tank. No change to the actual design of the tank was needed and there was no change to the language of the AP1000 DCR.

The NRC also notes that one of the petitions (dated June 16, 2011), which the NRC is responding to in the comment response document (ADAMS Accession No. ML112212319), specifically raised this issue and the NRC has provided an answer similar to that described above.

Debris Limits

In its December 20, 2010, letter on long-term core cooling (ADAMS Accession No. ML103410348), the Advisory Committee on Reactor Safeguards (ACRS) concluded that the regulatory requirements for long-term core cooling for design-basis accidents have been adequately met, based on cleanliness requirements specified in the amendment. In particular, the amount of latent debris that might be present in the containment is an important parameter. The ACRS further stated that any future proposed relaxation of the cleanliness requirements will require substantial additional data and analysis. In their January 24, 2011, report on the Vogtle COL application (ADAMS Accession No. ML110170006), which references the AP1000 design, the ACRS recommended that the containment interior cleanliness limits on latent debris should be included in the Technical Specifications for the Vogtle plant.

In a letter dated February 23, 2011 (ADAMS Accession No. ML110590455), Westinghouse proposed DCD markups to designate information in Section 6.3 including debris sources such

as latent debris (and the amount of fiber) as Tier 2*. Revision 19 of the DCD included changes to mark selected information as Tier 2*.

The NRC made a conforming change to the final rule language to provide a new item as Section VIII.B.6(b)(7) entitled general screen design criteria for this new type of Tier 2* information. The NRC believes that inclusion of debris limits in the AP1000 DCD as Tier 2* information, rather than including such limits in each plant referencing the AP1000, represents a better regulatory approach for achieving the intent of the ACRS. Inclusion of debris limits in the AP1000 and its designation as Tier 2* would ensure that there is consistency across all referencing plants with respect to debris control, and ensures NRC regulatory control of any future relaxations of the limits, as discussed in the NRC staff's March 3, 2011, response to the ACRS (ADAMS Accession No. ML110350198).

The staff does not believe that this change to the DCD marking or to the final rule language requires renoticing because the ACRS letter, staff response, and Westinghouse letter were all publicly available during the comment period and the public had a fair opportunity to comment on this matter. In this regard, the staff notes that the April 6, 2011, "petition" (filed by John Runkle) that requested the NRC to suspend the AP1000 amendment rulemaking, included discussion about this topic with specific reference to the ACRS letter (ADAMS Accession No. ML11108A077). Numerous other comment submissions pointed to this petition as part of their comments. This lends support to the staff's view that the public had adequate notice and an opportunity to comment on this matter. In addition, the inclusion of debris limits as Tier 2* represents a new limitation, not present in the prior revisions of the AP1000 DCD, which will require a referencing COL holder to use debris limits as specified in the AP1000 DCD. Given that the designation of the debris limits as Tier 2* represents a new restriction agreed to by Westinghouse, a matter on which the NRC received public comment, the staff does not believe that an additional opportunity for public comment need be provided on the inclusion of debris limits in Revision 19 of the DCD and the designation of those limits as Tier 2*.

Heat Sinks and Containment Pressure Analysis

In its December 13, 2010, letter on the AP1000 design certification (ADAMS Accession No. ML103410351), the ACRS identified an error in the previously certified Revision 15 of the DCD, concerning the containment cooling analysis. The error affected the time at which steady-state film coverage is achieved on the exterior of the containment vessel. In a February 5, 2011, letter, the NRC staff agreed with the ACRS, and indicated that Westinghouse agreed that the error existed and should be corrected. The letter also indicated that the NRC staff would monitor Westinghouse's corrective actions and review any needed revisions to the DCD (ADAMS Accession No. ML103560411).

In the course of correcting the steady-state film coverage error, after the proposed rule was published, Westinghouse identified other errors and modeling updates in supporting analyses that affected the calculated post-accident peak containment pressure the highest peak pressure in the event of a large break loss-of-coolant accident). The net impact of correcting the steady-state film error and the subsequent Westinghouse identified errors and modeling updates was an increase in calculated peak containment pressure from 57.8 psig to 59.2 psig, which would have exceeded the 59 psig post-accident peak containment pressure acceptance criterion in the existing AP1000 DCR.

Therefore, as part of the revised analysis to account for all the identified errors, Westinghouse relied upon a limited number of existing structural elements (gratings) within the containment as heat sinks, in order to remain within the 59 psig post-accident containment pressure acceptance.

Westinghouse's revised analysis used the NRC-approved methodology in the existing AP1000 DCR containment pressure calculation, and the method for crediting heat sink capacity as described in Westinghouse documents WCAP-15846 (proprietary) and WCAP-15862 (non-proprietary) "WGOthic Application to AP600 and AP1000," Revision 1, March 2004, which are incorporated by reference in the previously certified Revision 15 of the DCD. In addition, the Westinghouse revised analysis used the NRC-approved 59 psig post-accident peak containment pressure acceptance criterion in the existing AP1000 DCD, Revision 15.

The staff safety evaluation of the Westinghouse revised analysis is included in Sections 23.X and 23.Y of the final safety evaluation report (ADAMS Accession No. ML112061231). Table 6.2.1.1-10 of Revision 19 of the DCD includes the credited elements. The ACRS reviewed the Westinghouse corrections, and agreed that Westinghouse's revised analysis continues to demonstrate that the containment will be able to withstand the post-accident peak containment pressure (ADAMS Accession No. ML11256A180), and that the reevaluated pressure is based on a sufficiently conservative methodology. The final AP1000 rule language designates this "heat sink data for containment analysis" by adding it as a new Tier 2* item in Section VIII.B.6.b(8). The staff decided to control any future changes to the credited elements by designating the material as Tier 2* because the geometry and location of the heat sinks could impact their effectiveness.

The staff does not believe that the revisions to Table 6.2.1.1-10 of Revision 19 of the DCD require renoticing for several reasons. The gratings to be credited as heat sinks were already part of the approved AP1000 design and were not part of the proposed amendment to the AP1000 DCR described design. Thus, the actual DCD did not involve the addition of any new design elements. The use of heat sinks as part of the containment pressure calculation, and the method for crediting heat sink capacity were described in the DCD Revision 15. The criterion for evaluating the acceptability of the change continues to be the calculated post-accident peak containment pressure of 59 psig. Therefore, the revised Westinghouse analysis did not involve the use of any previously unapproved design methodologies or acceptance criteria; the methodology used and the acceptance criterion (59 psig post-accident peak containment pressure) is in the already-approved AP1000 DCR. Finally, crediting of the gratings as heat sinks in the revised analysis did not introduce any new safety issues not previously addressed. Therefore, the staff does not believe that opportunity for public comment need be provided on the Westinghouse revised analysis. The NRC does not believe that the designation of the heat sink as Tier 2* requires renoticing. As discussed above, the Tier 2* change is a direct result of the Westinghouse revised analysis, which does not warrant an additional opportunity for public comment. The designation of this information as Tier 2* adds a new limitation, not present in the prior revisions of the AP1000 DCD, which limits a referencing COL applicant/holder to alter the heat sink information for the grating and all other heat sinks credited in the containment peak pressure analysis. Given that the designation of the heat sink information as Tier 2* represents a new restriction agreed to by Westinghouse, the staff does not believe that opportunity for public comment need be provided on the Westinghouse revised analysis.