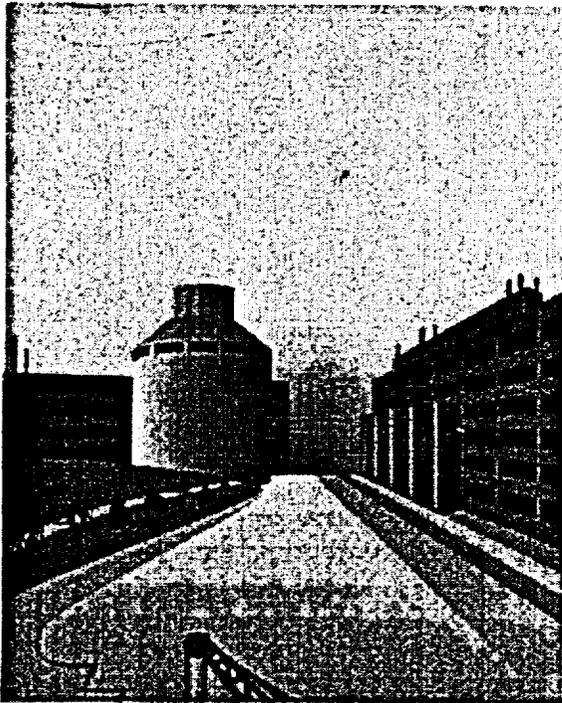
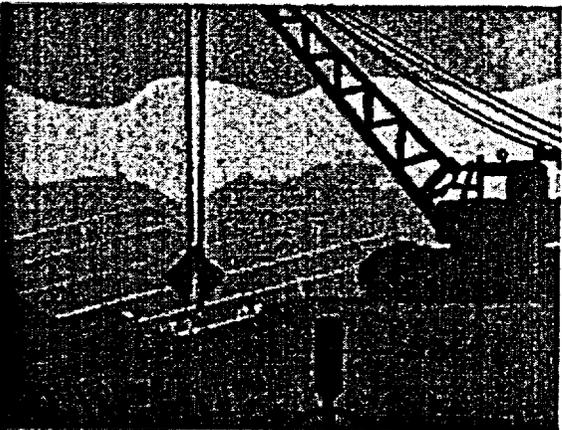


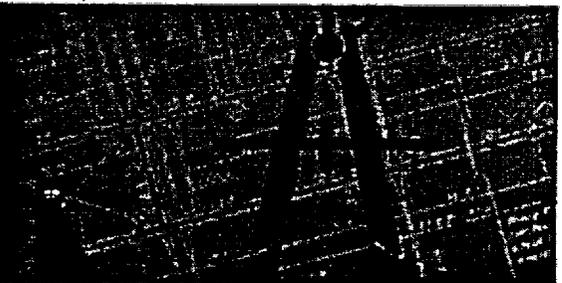
NUREG-1512



**Final Safety
Evaluation Report
Related to Certification
of the AP600 Standard Design**



Supplement 1



Docket No. 52-003



**U.S. Nuclear Regulatory
Commission**
Office of Nuclear Reactor Regulation



1 INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This report supplements the final safety evaluation report (FSER) for the AP600 Standard Plant Design. The U.S. Nuclear Regulatory Commission (NRC) staff issued the FSER as NUREG-1512 in September 1998 to document the NRC staff's review of the AP600. This supplement documents the NRC staff's review of the changes to the AP600 design documentation since the issuance of the FSER and the resolution of the confirmatory items identified in Section 1.9 of the FSER. This supplement also provides an evaluation of the design change described below. Each of the following sections of this supplement is numbered and titled the same as the section of the FSER that is being updated. The discussions are supplementary to, and not in lieu of, the discussions in the FSER, unless otherwise noted.

Westinghouse Electric Company LLC (Westinghouse or the applicant) submitted the AP600 design documentation under Subpart B of 10 CFR Part 52. The AP600 design documentation includes the AP600 Standard Safety Analysis Report, Probabilistic Risk Assessment, and Design Control Document (DCD). The AP600 DCD (Docket No. 52-003) was submitted after issuance of the FSER. The staff's review of the DCD is discussed in Section 1.5 of this report.

This supplement is issued by the Division of Regulatory Improvement Programs in the Office of Nuclear Reactor Regulation, NRC. The NRC's project manager for the AP600 design review is Jerry N. Wilson, PE. He may be reached by calling 301-415-3145, or by writing to him at the Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. The AP600 design documentation and all revisions are available for public inspection at the NRC's Public Document Room, 2120 L Street NW., Washington, DC 20555-0001. Also, the AP600 FSER (NUREG-1512) and this supplement are available for public inspection at the NRC's Public Document Room.

1.1.2 Proprietary Information

The NRC staff stated in the FSER that Westinghouse needs to formally update the non-proprietary versions of some of its proprietary documents to reflect the results of the NRC staff's review under 10 CFR 2.790. Submittal of the revisions to the non-proprietary versions of these documents was Confirmatory Item 1.1.2-1.

By letter dated December 22, 1998 (DCP/NRC 1451), Westinghouse submitted the final outstanding item concerning proprietary information related to the AP600 design review. The NRC staff determined that the non-proprietary versions of the AP600 proprietary documents were acceptable and, therefore, Confirmatory Item 1.1.2-1 is resolved.

1.5 Summary of Principal Review Matters

The NRC staff stated in the FSER that, if Westinghouse decides to proceed with certification of the AP600 design, it must prepare a DCD. Submittal of the DCD was Confirmatory Item 1.5-1. By letter dated November 30, 1998 (DCP/NRC 1448), Westinghouse submitted the AP600 DCD. The NRC staff commented on the DCD and Westinghouse addressed all of the staff's comments in four revisions to the DCD (2/99, 3/99, 9/99, and 12/99). The NRC staff

determined that the AP600 DCD (including the four revisions) is acceptable for referencing in the final design certification rule and, therefore, Confirmatory Item 1.5-1 is resolved.

The NRC staff approved the 2/99 and 3/99 revisions to the DCD in letters to Westinghouse dated February 18, and April 7, 1999. By letter dated September 29, 1999 (DCP/NRC 1455), Westinghouse submitted documentation changes to the AP600 DCD (9/99 revision) as a result of a final review that was performed to check the consistency of the implementation of approved design change proposals. Also, DCD changes resulted from ongoing detailed design work on systems, structures, and components outside the scope of design certification and commitments made in the final stages of the design certification review. In addition, changes to the description of the plates that protect the recirculation pump screens were necessitated by the location of other nearby hardware. These documentation changes are listed in Table 1.5-1 and the staff's evaluation of the design change appears in Section 6.2.1.8 of this supplement.

The NRC staff reviewed the documentation changes that were made to resolve inconsistencies in the AP600 DCD and to correct administrative errors (9/99 and 12/99 revisions). The staff determined that these administrative changes are acceptable and do not affect the staff's findings in the AP600 FSER. The NRC staff will send a letter to Westinghouse approving the 9/99 and 12/99 revisions to the AP600 DCD.

1.7 Index of Tier 2* Information

The NRC staff identified Tier 2* information in the AP600 and stated that designation of the Tier 2* information in the AP600 DCD was Confirmatory Item 1.7-1. The NRC staff verified that all of the Tier 2* information for the AP600 design was accurately designated in the DCD. Therefore, Confirmatory Item 1.7-1 is resolved.

1.9 Summary of Confirmatory Items

The staff listed three confirmatory items in the FSER and stated that these items would be resolved during the NRC staff's review of the AP600 DCD. Each confirmatory item was assigned a unique identifying number. The number identifies the section of the FSER in which the item was discussed. For example, Confirmatory Item 1.5-1 was discussed in Section 1.5 of the FSER. All of the confirmatory items have been resolved, as discussed in the corresponding sections of this report.

| <u>Item</u> | <u>Description</u> |
|--------------------|--|
| 1.1.2-1 | Westinghouse will submit updates to the non-proprietary versions of certain documents withheld from public disclosure in accordance with 10 CFR 2.790. |
| 1.5-1 | Westinghouse will submit the design control document to support its application to certify the AP600 design. |
| 1.7-1 | The Tier 2* information must be designated in the DCD. |

Table 1.5-1 Summary of Changes to the AP600 DCD

| PAGE | SECTION | DESCRIPTION |
|-----------------------------|--|--|
| Tier 1 material 2.2.3-21 | Tier 1 material 2.2.3, Table 2.2.3-4, vii | Correct the description of the plate located above the containment recirculation screen |
| Tier 1 material 2.2.3-22 | Tier 1 material 2.2.3, Table 2.2.3-4, viii | Correct the description of the coating area under the plate located above the containment recirculation screen |
| 1.9-13 | 1.9.3 | Correct quote from 10 CFR 50.34(f)(2)(viii) |
| 1.9-14 | 1.9.3 | Correct quote from 10 CFR 50.34(f)(2)(viii) |
| 3.7-191 | Figure 3.7.2-12 (Sheet 2 of 12) | Make figure consistent with room drawings |
| 3.8-39 | 3.8.3.6.1 | Make text description consistent with figure 3.8.3-14 |
| 3.8-133 | Figure 3.8.3-1 (Sheet 1 of 3) | Change drawing to allow space to weld guard pipe - Construct ability issue |
| 3.8-134 | Figure 3.8.3-1 (Sheet 2 of 3) | Make figure consistent with PXS screen design |
| 3.8-151 | Figure 3.8.3-7 (Sheet 1 of 9) | Make figure consistent with Figure 3.8.3-5, Sheet 1 |
| 3.8-155 | Figure 3.8.3-7 (Sheet 3 of 9) | Make figure consistent with room drawings |
| 3.8-157 | Figure 3.8.3-7 (Sheet 4 of 9) | Make figure consistent with room drawings |
| 3.8-159 | Figure 3.8.3-7 (Sheet 5 of 9) | Make figure consistent with Figure 1.2-7 |
| 3.8-161 | Figure 3.8.3-7 (Sheet 6 of 9) | Make figure consistent with room drawings |
| 3.8-163 | Figure 3.8.3-7 (Sheet 7 of 9) | Make figure consistent with room drawings |
| 6.2-47 | 6.2.4.2.2 | Change value of max hydrogen concentration from 1.5 to 2.2 % |
| 6.2-52 | 6.2.4.3.3 | Change time flammability limit is reached from 28 days to 12 days |
| 6.2-129 | Table 6.2.4-5 | Insert new containment temperature and corrosion rate data |
| 6.2-156 | Figure 6.2.4-1 | Update hydrogen generation curve to reflect final WGOTHIC analysis |
| 6.2-157 | Figure 6.2.4-2 | Update hydrogen generation curve to reflect final WGOTHIC analysis |
| 6.2-158 | Figure 6.2.4-3 | Update hydrogen generation curve to reflect final WGOTHIC analysis |
| 6.2-159 | Figure 6.2.4-4 | Update hydrogen generation curve to reflect final WGOTHIC analysis |

Continue Table 1.5-1

| | | |
|----------|----------------------------------|--|
| 6.3-18 | 6.3.2.2.7.1 | Make description of the plate located above the containment recirculation screen consistent with Tier 1 material |
| 6.3-21 | 6.3.2.2.7.3 | Make description of the plate located above the containment recirculation screen consistent with Tier 1 material |
| 6.3-53 | 6.3.7.6.2.3 | Add text to correct an inconsistency concerning the PRHR HX inlet MOV power lockout |
| 6.3.70 | Table 6.3-3 | Change table note to correct an inconsistency concerning the PRHR HX inlet MOV power lockout |
| 6.3-88 | Figure 6.3-8 | Make outline of plate located above the containment recirculation screen consistent with Tier 1 material |
| 6.3-89 | Figure 6.3-9 | Make elevation of plate located above the containment recirculation screen consistent with Tier 1 material |
| 9A-81 | 9A.3.1.3.1.2 | Correct spelling of the word "fire" |
| 9A-82 | 9A.3.1.3.1.3 | Correct fire area numbering |
| 9A-83 | 9A.3.1.3.1.3 | Correct spelling of the word "fire" |
| 9A-217 | Figure 9A-3 (Sheet 1 of 3) | Make figure consistent with text |
| 9A-219 | Figure 9A-3 (Sheet 2 of 3) | Make figure consistent with text |
| 12.3-57 | Figure 12.3-2 (Sheet 2 of 15) | Include rest of post-accident access route |
| 3.5-11 | 16.1.1 | Add technical specification surveillance requirement for PRHR HX inlet MOV power lockout |
| B 3.5-23 | 16.1.1 | Add technical specification bases for PRHR HX inlet MOV power lockout |

6 ENGINEERED SAFETY FEATURES

6.2.1.8 Debris in IRWST and Containment Sumps—Strainer Clogging

Westinghouse proposed changes to the plates located above the containment recirculation screens and the surface area covered by a safety-related coating in the vicinity of the containment recirculation screens. The proposed changes are marked on pages 6.3-18 and 6.3-21 of the AP600 DCD (9/99 revision) and are shown on Figures 6.3-88 and -89.

Westinghouse made two changes to these plates: (1) the plates have been lowered from 10 feet above the screens to 1 foot above the screens and (2) the plates have been shortened so that the distance from the end of the plate to the screen is 7 feet on the side rather than the previous value of 10 feet. Both changes are acceptable based on the debris transport analyses that were presented at a meeting with Westinghouse on September 2, 1999. These analyses show that the debris will not clog a significant portion of the screens at the "best estimate" or design settling rates. Westinghouse also stated that these analyses were done assuming a higher flow from the non-safety-related pumps than would occur for the safety-related case (in which the non-safety-related pumps are not running). In addition, because the plates have been lowered to one foot above the screens, the area requiring safety-related coatings is reduced. For these reasons, the new dimensions of the protective plates and the area of the safety-related coatings are acceptable.

Because of Westinghouse's changes to the size of the protective plates and the area of the safety-related coatings, the NRC staff is revising the last three sentences of the second paragraph on page 6-57 of NUREG -1512, as follows:

To prevent plugging of the recirculation screens, the plates will either be made of stainless steel or safety-related coatings will be used on the underside of these plates. Stainless steel or safety-related coatings will also be used on the surfaces located below the plates, above the bottom of the screens, 3 m (10 ft) in front, and 2.1 m (7 ft) to the side of the screens. The plates and their dimensions will be verified by the inspections, tests, analyses, and acceptance criterion (ITAAC) 8.c (vii) of Tier 1 Section 2.2.3, "Passive Core Cooling System." The materials used on the underside of the plates and in the vicinity of the recirculation screens will be verified by ITAAC 8.c (xiii) of Tier 1 Section 2.2.3.

23 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The Advisory Committee on Reactor Safeguards (ACRS) considered the information discussed in this supplement to the AP600 FSER (NUREG-1512) during its 467th meeting on November 5, 1999, and subsequently issued a letter on November 12, 1999. In its letter, which follows, the Committee concluded that Westinghouse's changes to the AP600 Design Control Document did not change its conclusion in the ACRS report on the AP600 design, dated July 23, 1998.

November 12, 1999

The Honorable Richard A. Meserve
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Chairman Meserve:

SUBJECT: PROPOSED FINAL DESIGN CERTIFICATION RULE AND CHANGES TO THE DESIGN CONTROL DOCUMENT ASSOCIATED WITH AP600 DESIGN

During the 467th meeting of the Advisory Committee on Reactor Safeguards, November 4–6, 1999, we reviewed the changes to the AP600 Design Control Document and the associated Supplement 1 to NUREG-1512, "Final Safety Evaluation Report Related to Certification of the AP600 Standard Design." We also considered the proposed final AP600 Design Certification Rule. During our review, we had the benefit of discussions with representatives of the NRC staff and Westinghouse Electric Company, and of the documents referenced.

Conclusion

- Our review of the changes to the AP600 Design Control Document and the associated Supplement 1 to NUREG-1512 did not change the conclusion in our report of July 23, 1998. In that report, we concluded that acceptable bases and requirements have been established to ensure that the AP600 design can be used to engineer and construct plants that, with reasonable assurance, can be operated without undue risk to the health and safety of the public.
- We decided not to review the proposed final AP600 Design Certification Rule since it is essentially the same as the rules for certification of evolutionary nuclear power plant designs (General Electric Advanced Boiling Water Reactor design and ABB-Combustion Engineering System 80+ design.).

Background and Discussion

We reviewed the AP600 standard design in accordance with 10 CFR Part 52, which requires the ACRS to report on those portions of the application that concern safety. In our present review, we considered changes to the AP600 Design Control Document, including changes to the design of the plate above a containment sump screen and an increase in the calculated concentrations of hydrogen in the containment following a loss-of-coolant accident (LOCA).

The area of the plate was reduced to avoid mechanical interference with a steam generator. The redesigned plate was also lowered closer to the top of the containment sump screen in order to reduce debris accumulation on the screen. The design change was judged to increase safety.

Results of the calculations using the final version of the WGOTHIC code demonstrated that the long-term containment temperatures following a LOCA are higher than originally predicted. The higher temperatures lead to a predicted increase in the hydrogen concentrations. However, the post-LOCA hydrogen concentrations remain well below flammability limits throughout the accident.

Sincerely,

Dana A. Powers
Chairman

References

1. Memorandum dated September 28, 1999, from David B. Matthews, Office of Nuclear Reactor Regulation, NRC, to John T. Larkins, ACRS, Subject: Final Rule—AP600 Design Certification.
2. Memorandum dated October 7, 1999, from David B. Matthews, Office of Nuclear Reactor Regulation, NRC, to John T. Larkins, ACRS, transmitting Supplement 1 to the AP600 Final Safety Evaluation Report.
3. Letter dated September 29, 1999, from Brian A. McIntyre, Westinghouse Electric Company, to Document Control Desk, NRC, transmitting AP600 Design Control Document, September 1999 Revision.
4. Letter dated September 15, 1999, from Jerry N. Wilson, Office of Nuclear Reactor Regulation, NRC, to Westinghouse Electric Company, Subject: Meeting Summary On Design Control Document Changes.
5. Report dated July 23, 1998, from R. L. Seale, Chairman, ACRS, to Shirley Ann Jackson, Chairman, NRC, Subject: Report on the Safety Aspects of the Westinghouse Electric Company Application for Certification of the AP600 Passive Plant Design.

24 CONCLUSION

The NRC staff completed its review of the revisions that were made by Westinghouse to the AP600 design documentation (refer to the discussion in Section 1.5 of this report). The 9/99 revision to the AP600 DCD was reviewed by the Advisory Committee on Reactor Safeguards, as described in Chapter 23 of this report. On the basis of the evaluation described in the AP600 FSER (NUREG-1512) and this report, the NRC staff concludes that the confirmatory issues in NUREG-1512 are resolved, the AP600 design documentation (up to and including the 12/99 revision to the AP600 DCD) is acceptable, and Westinghouse's application for design certification meets the requirements of Subpart B to 10 CFR Part 52 that are applicable and technically relevant to the AP600 Standard Plant Design.

**Appendix H
ERRATA TO THE AP600 FSER**

| <u>Page, Paragraph, Line</u> | <u>Change</u> |
|--|--------------------------------|
| Page 6-69, 1 st paragraph, 3 rd line | Change "diameter" to "radius". |