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Revision 0

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Applicant's Supplemental Environmental Report - Amendment to ABWR Standard Design Certification

ABWR Design Change Proposal Review for Impacts to the Assessment of Severe Accident Mitigation Design Alternatives

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1.0 Introduction

On June 30, 2009, STP Nuclear Operating Company (STPNOC) applied to the NRC (Reference 1) for amendment of the Design Certification Rule for the ABWR to reference Revision 5 of the Design Control Document (DCD) in order to address the requirements of 10 CFR 50.150, the Commission's new aircraft impact rule. This new rule, which was published in the Federal Register on June 12, 2009 (Reference 2), requires applicants for new nuclear power reactors to perform a design-specific assessment of the effects of the impact of a large, commercial aircraft. The applicant is required to use realistic analyses to identify and incorporate design features and functional capabilities to show, with reduced use of operator actions, that either the reactor core remains cooled or the containment remains intact, and either spent fuel cooling or spent fuel pool integrity is maintained. Revision 5 to the ABWR DCD describes the results of such an assessment of the certified ABWR design and identifies and incorporates design features and functional capabilities to show, with reduced use of operator actions, that the reactor core remains cooled and spent fuel pool integrity is maintained. The identified design features include changes to the ABWR design as documented in DCD Revision 4.

This supplemental environmental report is being provided to satisfy the requirements of 10 CFR 51.55(b), and evaluates the impact of the design changes identified by STPNOC on the assessment of Severe Accident Mitigation Design Alternatives (SAMDAs). Section 51.55(b) states:

> Each applicant for an amendment to a design certification shall submit with its application a separate document entitled, "Applicant's Supplemental Environmental Report—Amendment to Standard Design Certification." The environmental report must address whether the design change which is the subject of the proposed amendment either renders a severe accident mitigation design alternative previously rejected in an environmental assessment to become cost beneficial, or results in the identification of new severe accident mitigation design alternatives that may be reasonably incorporated into the design certification.

This supplemental environmental report provides the results of a review to determine whether any of the SAMDAs previously rejected in the NRC's environmental assessment (Reference 4) are rendered cost-beneficial by the design changes, or results in the identification of a new SAMDA that reasonably may be incorporated into the ABWR design certification. As discussed below, the design changes do not cause a previously rejected SAMDA to become cost beneficial or result in the identification of new SAMDAs that may be reasonably incorporated into the ABWR design.

2.0 Technical Review

The design changes that were identified in the June 30, 2009 STPNOC application were reviewed for their impact on the NRC's assessment of SAMDAs for the ABWR design. A two-step evaluation process was used to determine the impact of each design change on the SAMDA assessment.

1. The design change is evaluated to determine if there is a change to a PRA-modeled System, Structure, and Component (SSC). (The term "PRA-modeled System, Structure, and Component (SSC)" is defined as an SSC that is currently modeled in the ABWR Probabilistic Risk Assessment (PRA), or a SSC that, after evaluation, should be modeled in the ABWR PRA).

    a. A response of "No" eliminates the design change from further consideration.

    b. A response of "Yes" identifies the design change for further evaluation

2. The design changes identified for further evaluation in 1.b (above) are qualitatively evaluated for PRA impact. Expert judgment is used to determine whether the change has a risk-beneficial or risk-negative impact.

    a. Risk-beneficial design changes are not considered for further evaluation. For these design changes, the conclusion is that the current PRA model remains bounding.

    b. Risk-negative design changes are to be evaluated to quantify the increase in Core Damage Frequency and Large Release Frequency.

Table 1 summarizes the results of the review of the evaluated design changes that have a PRA impact. The conclusion from the table is that none of the design changes has a negative impact on ABWR plant risk as evaluated in the ABWR PRA. The results of the ABWR PRA provide input to the ABWR SAMDA assessment. Because the ABWR PRA will not be modified as a result of this review, and consequently the ABWR PRA results will not change, the ABWR SAMDA assessment documented in Reference 4 remains valid and applicable to ABWR DCD Revision 5.

Table 1 Design Change Review

Change Description	PRA Impact	Comments
Addition of Alternate Feedwater Injection (AFI) System	None	The AFI adds a new and diverse water supply for core cooling which is separate and independent from existing sources. Backleakage through this system is minimized by: (1) two existing safety-grade isolation check valves located in the reactor building, (2) two new normally closed motor-operated valves (MOVs), and (3) a leak off line which directs any leakage past the two check valves and one MOV back to the reactor building. The AFI pump has the same capacity and head as the High Pressure Core Flooder pump currently provided in the ABWR design. The AFI is manually actuated and controlled in the AFI pump house. The addition of a manually actuated backup to the existing high pressure injection systems provides a net benefit in terms of risk reduction over the existing ABWR design. The quantitative effect of the addition of AFI is small however.
Additional Nitrogen Supply Line for one Safety/Relief Valve (SRV)	None	This supplies additional depressurization capability for the Reactor Pressure Vessel (RPV). The design change does not reduce the reliability of the existing N2 supply to the SRV as the new line will be separate from the existing lines and will have its own separate source of high pressure nitrogen located remotely from all other sources. The likelihood of backleakage through this line is remote as it does not communicate with containment atmosphere and also contains two safety-grade isolation valves. The new nitrogen line will have its own penetration through the containment. Containment integrated leak rate testing and penetration testing will still be performed and will still be subject to the same leakage limits as described in DCD Subsection 6.2.6 and the Technical Specifications. Because the new penetration is small, the N2 system pressure capability is greater than the containment pressure capability, and the system is normally closed outside containment, there is no quantifiable effect on the consequences presented in the ABWR PRA.

Table 1 Design Change Review

Change Description	PRA Impact	Comments
Instrumentation Added for AFI	None	This change does not impact PRA models and assumptions as the credited instrumentation remains unaffected. This instrumentation can provide additional information for operators when existing instrument and control systems are potentially unavailable (e.g., long-term station blackout). This provides a net benefit in terms of risk reduction for the ABWR design. Quantitatively, the effect would be very small.
Addition of New Fire Doors/conversion of Non-Rated Doors to 3-hour Fire Doors	None	Additional fire barriers added in the reactor building. None of the existing fire barriers are eliminated or reduced. There is potentially a net benefit for risk reduction purposes in the addition of additional fire barriers. Because of the nature of the fire screening assessment performed for the ABWR design, there is no change to fire screening results presented in the ABWR PRA.

3.0 Regulatory Impact

The ABWR DCD Revision 5 design changes were reviewed to determine whether any impacted the ABWR PRA and the assessment of SAMDAs. The results indicate that there are no design changes that will result in a change to the ABWR PRA or DCD Chapter 19. No new severe accidents are created as a result of these design changes.

The results of the ABWR PRA provide input to the ABWR SAMDA assessment. Because the ABWR PRA will not be modified as a result of this review, and consequently the ABWR PRA results will not change, the ABWR SAMDA assessment documented in Reference 4 remains valid and applicable to ABWR DCD Revision 5.

Additionally, the results of this evaluation indicate that the previously considered SAMDAs that were previously rejected in the environmental assessment for the ABWR (Reference 4), or otherwise considered (Reference 3), did not become cost beneficial due to the design changes. Furthermore, this evaluation did not identify new SAMDAS that may be reasonably incorporated into the ABWR design.

4.0 Revisions to the Design Control Document

There are no revisions to the DCD as a result of this evaluation.

5.0 Revisions to the Probabilistic Risk Assessment

There are no revisions to the PRA.

6.0 References

1. Letter No. U7-C-STP-NRC-090070 "Application to Amend the Design Certification Rule for the US Advanced Boiling Water Reactor (ABWR)" dated June 30, 2009.
2. 74 Fed. Reg. 28,112 "Consideration of Aircraft Impacts for New Nuclear Power Reactors" dated June 12, 2009.
3. Letter from J. F. Quirk (GE) to R.W. Borchardt (NRC) titled "NEPA/SAMDA Submittal for the ABWR" dated December 21, 1994 which transmitted "Technical Support Document for the ABWR", 25A5680, Attachment A.
4. Letter from R.W. Borchardt (NRR) to J. Quirk (GENE) dated March 16, 1995 transmitting document titled "Environmental Assessment by the Office of Nuclear Reactor Regulation Relating to the Certification of the U.S. Advanced Boiling Water Reactor Design Docket No. 52-001".