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POLICY ISSUE

(Information)

SECY-90-329

September 20, 1990

For: The Commissioners
From: James M. Taylor
 Executive Director for Operations

Subject: COMPARISON OF THE GENERAL ELECTRIC ADVANCED BOILING WATER REACTOR (ABWR) DESIGN AND THE ELECTRIC POWER RESEARCH INSTITUTE'S (EPRI'S) ADVANCED LIGHT WATER REACTOR (ALWR) REQUIREMENTS DOCUMENT

Purpose: To provide the Commission with information concerning the differences between the ABWR design and the requirements identified in the ALWR Requirements Document.

Background: In the December 15, 1989 staff requirements memorandum (SRM) relating to SECY 89-334, "Recommended Priorities for Review of Standard Plant Designs," the Commission transmitted the following guidance to the staff:

In order to provide added NRC status to the ALWR Requirements Document, when reviewing the specific designs, the staff should consider the ALWR Requirements Document and dedicate a section in each SER which highlights those areas where the resolution of evolutionary plant issues is different than the resolution achieved through the review of the ALWR requirements.

On June 12, 1990, the General Electric Company (GE) provided a list and a comparison of the differences between the ABWR design and the ALWR requirements (Enclosure 1). On June 15, 1990, Mr. John Taylor wrote to confirm EPRI's agreement with the GE letter (Enclosure 2).

Discussion: In the June 12, 1990 letter, GE identified nine items where the ABWR design differed from the ALWR requirements. These items are as follows:

1. Operating Basis Earthquake (OBE)
2. Timing of Fission Product Release

Contact:
 D.C. Scaletti, NRR/DRSP
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For 11

3. Metal Water Reaction
4. Containment Overpressure Protection
5. Electrical Power Distribution
6. Standby Gas Treatment System (SGTS)
Charcoal Filters
7. Fuel Cask Size
8. Main Control Room Work Station
Redundancy
9. Main Control Room Restrooms

Other items were identified by GE as being under discussion with EPRI. These items are as follows:

1. Radwaste Building
2. Fuel Pool Level Indication
3. SGTS Filter Redundancy

Of these 12 items identified by GE, 6 had previously been discussed with the Commission. In an SRM of June 26, 1990, the Commission responded to SECY 90-016. This SRM presented the Commission's guidance on the following issues: OBE, ALWR source term, hydrogen control, containment overpressure protection, SGTS charcoal filters, and SGTS filter redundancy. The ABWR design is consistent with the Commission's guidance on these issues.

The differences identified by GE and not covered by the Commission in the SRM on SECY 90-016 are discussed below:

1. Electrical Power Distribution - The ALWR requirements specify a three-tier electrical distribution system as follows:
 - "A first tier of systems shall consist of distribution systems feeding non-safety loads required exclusively for unit operation."
 - "A second tier shall include the distribution systems supplying power to permanent non-safety loads, i.e., non-safety loads that, due to their specific functions, are generally required to remain operational at all times or when the unit is shut down."
 - "A third tier shall consist of the distribution systems feeding safety (Class 1E) loads."

The ABWR design includes a two-tier distribution system. The ABWR loads that are defined by the second tier of the ALWR requirements have been allocated to one of the two tiers: either the non-Class 1E buses or the Class 1E buses. This design configuration is consistent with the staff's past licensing practice.

Additionally, the ABWR design includes three independent electrical divisions. Each division can shut the plant down, can receive its power from a diesel generator capable of supplying all of its Class 1E loads, and can be manually supplied by the station's alternate ac source (a gas turbine generator). The staff is reviewing the ALWR requirement and the ABWR design with regard to this issue. The staff will provide its evaluations in the safety evaluation reports (SERs) of the ALWR requirements and the ABWR design. The staff does not believe this to be a policy issue requiring a Commission decision for the ABWR. If a policy issue is identified during the staff's review, the issue will be provided for Commission consideration as soon as practicable.

2. Fuel Cask Size - The ALWR requirements specify, "A cask loading area shall be provided adjacent to the spent fuel pool and shall be large enough for the largest multiple assembly spent fuel shipping cask being designed by DOE."

The ABWR design complies with the ALWR requirement on the cask loading area with the exception of the size. The ABWR cask loading facility has been designed to accommodate the largest BWR cask currently available that is approved by the U.S. Department of Transportation. Because the ABWR accommodates a currently approved shipping cask, the staff believes that GE's design is acceptable.

3. Main Control Room Work Station Redundancy - The ALWR requirements specify, "The supervisor's workstation will be identical to the operator's workstation except that all of its plant equipment control functions shall be normally disabled." In an emergency, the supervisor's workstation could be enabled to permit plant control.

The ABWR main control room has been designed to have operator workstations and a monitoring-only workstation for the shift supervisor. The shift supervisor's workstation will not have the capability for plant control.

The staff is reviewing the ALWR human factors design requirements and the human factors design of the ABWR. The staff will report its findings in the respective SERs. The staff does not believe this to be a policy issue requiring a Commission decision for the ABWR. If a policy issue is identified during the staff's review, the issue will be provided for Commission consideration as soon as practicable.

4. Main Control Room Restrooms - The ALWR requirements specify, "A restroom adequate for both men and women shall be provided. This restroom shall not be shared with areas outside the main control room."

The ABWR design provides restrooms that are located directly outside the main control room. The facilities are shared with other areas outside the main control room. The staff believes that the ABWR design meets the stated intent of the ALWR requirement which is to minimize traffic into the control area. The staff finds the location of the ABWR restroom to be acceptable and consistent with past regulatory practice.

- 5. Radwaste Building - The ALWR requirements specify, "Interior walls of the radwaste building shall not be used for structural support of the exterior wall and roof of the radwaste building." The rationale attributed to this requirement is that it will permit future modification to the radwaste building, including the removal or relocation of interior walls, without affecting the structural shell of the building.

The ABWR design uses the interior walls of the radwaste building for structural support. The staff is reviewing the structural aspects of the ABWR design and expects, pending a favorable design analysis review of the ABWR structures, to find the use of interior supporting walls acceptable.

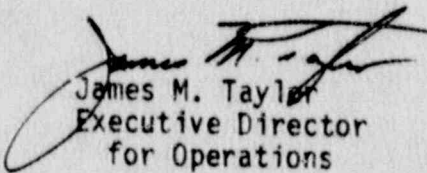
- 6. Fuel Pool Elevation Indication - The ALWR requirements specify that the spent "fuel pool level indication and low and high level alarms in the main control room" will be provided.

The ABWR design provides for only high and low spent fuel pool level indication in the control room. This provision is consistent with current staff practices and is considered acceptable for the ABWR design.

Conclusion:

In this paper, the staff is addressing only those differences between the ALWR requirements and the ABWR design that GE identified in the letter of June 12, 1990. The staff believes that the issues that GE has identified in the letter do not require policy decisions. However, if the staff identifies possible policy issues in the future, it will inform the Commission so it can determine if evolutionary ALWR designs should address these issues.

The Office of General Counsel has reviewed this paper and has no legal objection.


 James M. Taylor
 Executive Director
 for Operations

Enclosures:
As stated

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Daniel R. Wilkins
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Advanced Boiling Water Reactor Program
General Electric Company
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June 12, 1990

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Murley:

Subject: Comparison of ALWR Requirements
Document and GE ABWR SSAR Design

Please find attached our comparison of the ALWR Requirements Document and the GE ABWR SSAR design.

GE has been a major participant in the EPRI ALWR Requirements Program since its inception in 1985, and has worked closely with EPRI to achieve consistency of the ABWR SSAR design with the ALWR requirements. This effort has involved extensive technical dialog between GE, the Utility Steering Committee and the ALWR Program staff over the last five years. During this process, numerous enhancements were incorporated into the ABWR SSAR design to meet the ALWR requirements. A detailed comparison of the ABWR SSAR design to the several thousand ALWR requirements documented in the 13 chapters shows that the ABWR complies with all but the small number of ALWR requirements shown in the attachment. The results of this comparison have been reviewed with the EPRI ALWR program staff.

Table 1A documents areas where the ABWR SSAR design is different from specific ALWR requirements. Several of these stem from differences between ALWR requirements and GE's approach to addressing current regulatory requirements. In all cases, we believe the ABWR SSAR design provides an acceptable level of safety.

In addition, some items are still under discussion with EPRI ALWR Program staff. It is likely that these differences will be resolved in the future. These areas are provided in Table 1B.

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Dr. Thomas E. Murley
June 12, 1990
Page 2

The comparisons in the attached tables were made with respect to the version of the ALWR Requirements Document Volume II Chapter status listed in Table 2.

I hope the attached comparison is helpful in demonstrating to you and your staff that the ABWR SSAR design is highly consistent with the ALWR requirements.

Sincerely,



D. R. Wilkins

Attachments

cc: ALWR Utility Steering Committee
NRC Commissioners
ACRS Chairman
D. J. McGoff, DOE
J. Taylor, EPRI
B. Wolfe, GE

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TABLE 1A

LIST OF DIFFERENCES FROM SPECIFIC REQUIREMENTS

1. Operating basis earthquake.
2. Timing of fission product release.
3. Metal water reaction.
4. Containment overpressure protection.
5. Electrical power distribution.
6. Standby gas treatment system charcoal filters.
7. Fuel cask size.
8. Main control room work station redundancy.
9. Main control room restrooms.

TABLE 1A
DIFFERENCES FROM SPECIFIC REQUIREMENTS

1. Operating Basis Earthquake

Reference

Chapter 1, Rev. 1B, Section 4.5.2.4.4.1, Page 1.4-12 requires that the ". . . magnitude of the OBE shall be . . . independent of the magnitude of the SSE." Section 2.3.1.10 and Table 1.2-6 require the use of 0.1g for the OBE.

SSAR Design

The SSAR design has been analyzed for an OBE level corresponding to a value equivalent to half the SSE level, i.e., a bounding value of 0.15 g.

2. Timing of Fission Product Release

Reference

Chapter 5, Rev. 1-A, Section 1.2.3.4, Page 5.1-11 requires that the "Requirements document will assume that release of substantial amounts of fission products . . . would occur no sooner than about one hour after scram of the reactor."

SSAR Design

The SSAR analysis was done with two sets of assumptions -- one used the assumptions stated in the requirements and the second assumed instantaneous release. For both analyses the design met the applicable criteria.

TABLE 1A

DIFFERENCES FROM SPECIFIC REQUIREMENTS

3. Metal Water Reaction

Reference

Chapter 5 specifies that the containment shall be designed to handle ". . . an amount of hydrogen equivalent to that generated by oxidation of 75 percent of the fuel cladding surface. . ."

SSAR Design

The SSAR design uses inerting to prevent hydrogen detonation and has sufficient pressure capability, making the design insensitive to the percent of oxidation. The design pressure is determined by design basis accident LOCAs and sufficient margin exists between design pressure and applicable stress limits to handle 100% metal water reaction.

4. Containment Overpressure Protection

Reference

The ALWR requirements are silent with regard to containment overpressure protection, but are intended to provide adequate containment performance without requiring a containment vent.

SSAR Design

The ABWR SSAR design includes an overpressure protection feature, consisting of rupture disks and recloseable valves to preclude a large release of fission products resulting from uncontrolled failure of containment due to overpressure. The ABWR meets the ALWR requirements without reliance on this containment overpressure protection feature.

TABLE 1A

DIFFERENCES FROM SPECIFIC REQUIREMENTS

5. Electrical Power Distribution

Reference

A three-tier electrical distribution network is required by the ALWR requirements. Chapter 11, Rev. 0, Section 2.3.2, and Chapter 11, Section 4.3.3, page 11.4-9 (dedicated nonsafety buses) require that ". . . the onsite power distribution system shall follow a three-tier concept. . . . A second tier shall include the distribution systems supplying power to permanent nonsafety loads. . ." The rationale states that this concept ". . . in particular recognizes that redundant power sources. . . must be provided. . . for nonsafety loads expected to remain operational at all times (e.g., during a loss of offsite power). Chapter 11, Rev. 0, Section 2.3.9, page 11.2-8, requires ". . . non-Safety circuits are not connected to safety circuits. . ." In addition, other requirements also relate to this issue. These requirements include Chapter 9, Rev. 1A, Section 8.3.2.3.8, page 9.8-37 (powering drywell cooler fans during loss of off-site power events) and Chapter 11, Section 2.3.4, page 11.2-7 (dedicated sources for permanent nonsafety power loads) and Section 4.3.3 page 11.4-9 (dedicated non-safety buses).

SSAR Design

The SSAR design has a two-tiered power distribution system. Loads that would comprise the ALWR second tier have been allocated to either special top tier buses or isolable sections of safety buses, eliminating the second tier. The isolable non-IE loads connected to the safety buses are the instrument air compressor, 250V DC battery chargers, computer power supplies, three motor control centers and the reactor water cleanup system pumps. The SSAR design meets the four purposes stated in the rationale of Section 2.3.9 of Chapter 11.

TABLE 1A
DIFFERENCES FROM SPECIFIC REQUIREMENTS

6. SGTS Charcoal Filters

Reference

Chapter 9, Section 8.3.4.1.3 requires no charcoal filters in the SGTS.

SSAR Design

The SGTS design includes charcoal filters in the system.

7. Fuel Cask Size

Reference

Chapter 7, Section 2.3.2.5.1, Page 7.2-30, requires that the plant be designed for "... the largest multiple assembly spent fuel shipping cask being designed by the DOE.

SSAR Design

The cask loading facility is 10 feet square, large enough to accommodate the GE IF300 cask, which is the largest currently available.

8. Main Control Room Work Station Redundancy

Reference

Chapter 10, Rev. 0, Section 2.2.10, page 10.2-7, states that "The operators and supervisor in the Main Control Room will interface the plant through redundant workstations... The supervisor's workstation will be identical to the operator's workstation except that all of its plant equipment control functions shall be normally disabled."

SSAR Design

In the SSAR design, the main control room has operator work stations and a monitoring-only work station for the shift supervisor. The work stations in the SSAR design each have different functional requirements and none are identical to any of the others. However, they have functional redundancy and meet all of the ALWR requirements regarding reliability and the definition of work station functional allocation based upon comprehensive task analyses.

TABLE 1A

DIFFERENCES FROM SPECIFIC REQUIREMENTS

9. Main Control Room Restrooms

Reference

Chapter 10, Rev. 0, Section 4.9.1.4, Page 10.4-61, requires that the restroom for main control room personnel "shall not be shared with areas outside the main control room." The accompanying Rationale states, "A shared restroom increases the traffic into the control area."

SSAR Design

The SSAR arrangement provides restrooms which are located directly outside the main control room. These facilities are shared with areas outside the main control room.

TABLE 1B

DIFFERENCES WHERE DISCUSSIONS ARE ONGOING

1. Radwaste Building

Reference

Chapter 12, Section 2.2.7.4 requires that interior walls shall not be used for structural support.

SSAR Design

The SSAR design utilizes interior load bearing walls for structural support, in the large multi-story radwaste building.

2. Fuel Pool Level Indication

Reference

Chapter 8, Section 9.3.6.1, requires fuel pool level indication in addition to a low and high level alarm.

SSAR Design

The SSAR design has a level switch provided for low and high level alarms, to signal the small level changes expected during normal operation.

3. SGTS Filter Redundancy

Reference

Chapter 9, Section 8.3.4.1.3 requires that the SGTS have redundant divisions with two sets, including the passive components (filters).

SSAR Design

The SSAR design has redundant active components but uses a common passive filter train.

TABLE 2

ALWR REQUIREMENTS DOCUMENT VOLUME II CHAPTER STATUS, 3/14/90

<u>Chapter</u>	<u>Status</u>
1	Revision 1-B, Issued 1/90 ⁽¹⁾
1, Appendix A	Revision 0, Updated 2/90
1, Appendix B	Revision 1-B, Issued 2/90
2	Revision 1-A, Issued 12/90, plus boiler room 11/29/89
3	Revision 1-A, Issued 12/89, plus boiler room 2/20/90
4	Revision 1-A, Issued 10/89, plus comment resolution 2/90
5	Revision 1-A, Issued 11/89
6	Revision 1-A, Issued 11/89 ⁽¹⁾
7	Revision 1-A, Issued 1/90, plus boiler room 1/31/90
8	Revision 1-B, Issued 2/90
9	Revision 1-A, Issued 1/90, plus boiler room 2/22/90 ⁽¹⁾
10	Revision 0, Issued 10/89
11	Revision 1-A, Issued 1/90
12	Revision 1-A, Issued 1/90, plus boiler room 2/22/90
13	Revision 1-A, Issued 11/89

⁽¹⁾Plus agreements/discussions at GE/EPRI ALWR Program Staff meetings and telecons 5/4/90, 5/22/90 and 5/23/90.

EPRI

Electric Power
Research Institute

Leadership in Science and Technology

June 15, 1990

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: GE ABWR Certification

Reference: Letter, D. R. Wilkins to T. E. Murley, "Comparison of
ALWR Requirements Document and GE ABWR SSAR
Design," dated June 12, 1990

Dear Dr. Murley:

For the past several years, EPRI, DOE and the suppliers have been cooperating to develop requirements and designs for future ALWRs. This effort has included close cooperation between EPRI and GE to achieve consistency between the GE ABWR design for U.S. certification and the ALWR Requirements Document.

The reference letter provides the NRC with the comparison of the ABWR SSAR design with the current ALWR Requirements Document. The results of this comparison were reviewed with the EPRI ALWR Program staff prior to submittal, and reflect consistency of the ABWR SSAR design with the ALWR requirements. It reflects several years of dedicated effort by the Utility Steering Committee, EPRI and GE to resolve issues, and demonstrates a high degree of consensus within the industry on requirements and design for future BWRs.

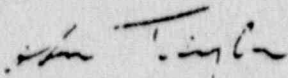
The differences which exist between the ALWR Requirements and the ABWR SSAR design are understandable given the fact that these programs were proceeding in parallel before all the issues could be completely resolved. Many of these differences represent areas where GE has elected to meet existing regulatory positions and requirements. The Utility Steering Committee is pursuing alternate resolution of these issues on future ALWR designs.

Enclosure 2

Dr. Thomas E. Murley
June 15, 1990
Page: 2

Certification of ALWRs which meet U.S. utility requirements, and demonstration of the new 10CFR Part 52 Standard Plant licensing process, are key objectives of the ALWR Program. The GE ABWR SSAR design, which incorporates U.S. utility ALWR requirements to a high degree, provides a unique opportunity to demonstrate the new 10CFR Part 52 Standard Plant licensing process. EPRI fully supports issuance of the Final Design Approval and certification of the ABWR SSAR design on the current schedule.

Sincerely,



John J. Taylor
Vice President Nuclear

JJT:WRS:JJTL/se0

cc: ALWR Utility Steering Committee
NRC Commissioners
ACRS Chairman
D. McGoff/DOE
B. Wolfe/GE