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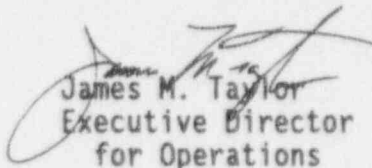
MEMORANDUM FOR: The Chairman
Commissioner Rogers
Commissioner Curtiss
Commissioner Remick
Commissioner de Planque

FROM: James M. Taylor
Executive Director for Operations

SUBJECT: QUARTERLY STATUS REPORT OF ADVANCED LIGHT WATER REACTOR
REVIEWS (JANUARY - MARCH 1993)

In a memorandum of June 20, 1991, I directed the staff to prepare quarterly reports outlining the status of its reviews of advanced reactor designs. The enclosed quarterly report is the seventh in the series and covers from January 1 through March 31, 1993.

In this report, the staff addresses the review status of the Electric Power Research Institute (EPRI) Utility Requirements Document (URD) for passive reactors, the GE Nuclear Energy (GE) Advanced Boiling Water Reactor (ABWR) design, the Asea Brown Boveri-Combustion Engineering (ABB-CE) System 80+ design, the Westinghouse AP600 design, and the GE Simplified Boiling Water Reactor (SBWR) design. The report consists of three sections: (1) an executive summary, (2) a discussion of technical and policy issues that could affect the schedule for more than one project, and (3) the status of the review of each advanced reactor project.


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Enclosure:
As Stated

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QUARTERLY STATUS REPORT OF
ADVANCED LIGHT WATER REACTOR REVIEWS
JANUARY-MARCH 1993

I. EXECUTIVE SUMMARY

This is the seventh quarterly report to the Commission on the status of the NRC staff's design certification reviews of evolutionary and advanced light-water reactors (ALWRs). The report addresses the GE Nuclear Energy (GE) Advanced Boiling Water Reactor (ABWR) design, the Asea Brown Boveri-Combustion Engineering (ABB-CE) System 80+ design, the Westinghouse AP600 design, the GE Simplified Boiling Water Reactor (SBWR) design, and the Electric Power Research Institute (EPRI) Utility Requirements Document (URD) for passive reactor designs. This report also includes a discussion of technical and policy issues that could affect the schedule for more than one project.

The staff and individual vendors have made significant progress on each of the advanced light-water reactor projects. Extensive efforts by the staff, GE, and ABB-CE have resulted in specific inspections, tests, analyses, and acceptance criteria (ITAAC) examples that will serve as a template for all ALWR designs. Although the development of this set of template ITAAC was a more difficult and time consuming task than anticipated, its completion removes a major obstacle to finishing the evolutionary design reviews. A significant amount of design development and review work remains to be completed by both the vendors and the staff, but there does not appear to be any major policy or technical issues that will prevent the eventual staff approval of the evolutionary designs.

Although the staff continues to resolve technical issues with GE and ABB-CE, its ability to prepare the FSER on these designs is largely dependent on submission of the final certified standard safety analysis report (SSAR) including ITAACs. For the ABWR, because so much information is needed to address the open issues in the draft final safety evaluation report (DFSER), GE revised its submission date for the certified SSAR and ITAACs to July 31, 1993. The staff estimated in SECY-93-041, "Advanced Boiling Water Reactor (ABWR) Review Schedule," that it could issue the final design approval for the ABWR in approximately nine months from the date GE identified.

ABB-CE completed its response to the System 80+ draft safety evaluation report (DSER) in February. However, ABB-CE acknowledged that more information is needed to supplement some of its responses. The staff completed a team review of 11 prototype ITAAC at the end of March. ABB-CE intends to submit all of its ITAACs by June 30, 1993, after it incorporates the lessons learned from this review.

ENCLOSURE

The staff made important progress on the issue of the regulatory treatment of active non-safety systems in the passive designs. This issue is important for the early review efforts on the AP600 and SBWR designs and for completion of the final safety evaluation report (FSER) for the EPRI URD for passive designs. EPRI submitted a proposed process for determining the regulatory treatment of non-safety systems based on an agreement between NRC senior management and the Utility Steering Committee made in January 1993. The staff is reviewing this document and expects to inform the Commission of its position on this issue in the next quarter.

The staff continued its review of the AP600 and SBWR design certification application material. For the AP600, the staff has issued almost 800 requests for additional information (RAIs) to Westinghouse and Westinghouse has responded to more than three-fourths of them. For the SBWR, on March 1, 1993, the staff received additional application information from GE. The staff is reviewing this information to determine whether the application contains all the information required by 10 CFR Part 52. The staff will complete this review early in the next quarter.

As a result of the delays in submittals (especially with regard to ITAAC) and the resource impact associated with staff support of the revised ABWR schedule, the staff is preparing revised integrated review schedules for standardized and advanced light-water reactor projects. Although these schedules will reflect the experience gained in the certification reviews and the substantial progress made on first-of-a-kind issues such as ITAAC, the schedules remain fundamentally linked to the timely receipt of high-quality design information from the vendors. The staff will provide these estimates to the Commission in the next quarter.

II. TECHNICAL AND POLICY ISSUES THAT COULD AFFECT REVIEW SCHEDULES

In items A through E, the staff discusses the status of five major policy issues that may affect the schedules for reviewing design applications.

A. ITAAC

The resolution of ITAAC is the most critical issue in reviewing the evolutionary LWR designs.

1. MILESTONES FOR LAST QUARTER

- a. Continue to review ITAAC submittals from the vendors and meet with the vendors, as necessary, to resolve issues raised during the review.
- b. Expedite the resolution of selected system ITAACs for the ABWR with the multi-disciplinary NRR review team.

- c. Brief the staff on the status of and the lessons learned from ITAAC development.

2. MILESTONES ACCOMPLISHED

During this quarter, the staff made significant progress on ITAAC issues from both a generic and design-specific perspective. In a memorandum to the Commission dated March 11, 1993, the staff described its approach to resolve the issue of generic ITAAC requirements such as welding and equipment qualification. In this approach, these generic requirements would be incorporated into the ITAACs for the specific applicable structures and systems of the design.

To effectively implement this technical approach and to resolve issues in the DFSER for the ABWR, the staff formed a multi-disciplinary ITAAC review team. From January 11 through 21, 1993, the team reviewed ten system ITAACs for the ABWR. In addition, from March 8 through 12, 1993, the team completed five more ITAAC systems (two building ITAAC, one electrical ITAAC, and one I&C ITAAC). GE is using the results of these reviews as a "template" for the other ABWR ITAACs.

Representatives from ABB-CE, Westinghouse, and the Department of Energy (DOE) attended both of the ITAAC review sessions. The staff anticipates that the other vendors will use the ITAAC "template" developed from the ABWR design and the other lessons learned when developing their ITAACs.

On March 5, 1993, ABB-CE submitted 11 prototype ITAACs for the System 80+ design. These ITAACs reflected staff comments and the industry review of the System 80+ ITAAC that was completed in February. The staff reviewed these revised ITAACs and provided appropriate feedback to ABB-CE in the last week of March.

In order to ensure consistent application of the lessons learned during the ITAAC reviews, the staff conducted a training session on ITAAC for its reviewers. In addition, the staff is writing preliminary review guidance, based on the lessons learned from the team reviews, to use in reviewing the final versions of ITAAC.

3. MILESTONES NOT ACCOMPLISHED

None.

4. EFFECT ON SCHEDULE AND RECOVERY

GE intends to submit its final ITAACs for the ABWR design by July 31, 1993. ABB-CE intends to submit its ITAACs by June 30, 1993, after incorporating staff feedback on the 11 prototype ITAACs. Westinghouse is following ITAAC development on both the GE and ABB-CE dockets and intends to submit revised AP600 ITAACs in June 1993. The staff factored these estimates into its Commission paper on integrated review schedules for standardized and advanced light-water reactor projects.

5. MILESTONE PLANNED FOR NEXT QUARTER

Prepare ITAAC review guidance and conduct an NRR training session.

B. SEVERE ACCIDENT CLOSURE

The probabilistic risk assessment (PRA) (FSER Chapter 19.1) and closure of severe accidents (FSER Chapter 19.2) represents a significant element of the staff review of advanced designs. To close the issue of severe accidents for advanced designs, the staff requires a balanced approach between severe accident prevention and mitigation. The basis for the review is to ensure that advanced plants have a higher degree of severe accident safety performance than previous designs and to take advantage of lessons learned from performance of PRAs, operating experience, and severe accident research.

1. MILESTONES FOR LAST QUARTER

- a. Develop a revised schedule for ABWR final design approval.
- b. Meet with ABB-CE on issues related to this topic in January 1993.

2. MILESTONES ACCOMPLISHED

The staff is using the Commission's Severe Accident Policy Statement and the Commission-approved positions from SECY-90-016, "Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationship to Current Regulatory Requirements," as primary guidance in determining the acceptability of the evolutionary designs for severe accidents. In SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," the staff refines its positions regarding

certain severe accident issues for evolutionary designs and makes its recommendations on numerous severe accident issues for the passive designs. The staff issued this paper to the Commission on April 2, 1993.

During this quarter, the staff continued to work with primarily GE, ABB-CE, and EPRI on issues related to severe accident closure to ensure that resolution is achieved consistent with Commission guidance and can be accomplished consistent with schedules established for other SSAR chapters. The staff has not identified any major implementation difficulties with respect to those goals. Also, during the quarter, the staff briefed the ACRS on severe accident closure for the ABWR. Another meeting is planned for the next quarter and will address committee concerns and discuss final resolution of issues. ABB-CE submitted the severe accident report for the System 80+ which incorporated the resolution of issues raised in the staff review of the initial report.

3. MILESTONES NOT ACCOMPLISHED

None.

4. EFFECT ON SCHEDULE AND RECOVERY

None.

5. MILESTONE PLANNED FOR NEXT QUARTER

Unless the Commission's consideration of the severe accident closure issues presented in SECY-93-087 raises generic items affecting this issue, the staff will no longer provide an update on severe accident closure in future quarterly reports. Significant design-specific implementation issues will be covered in the project summary section of this report.

C. DIVERSITY OF DIGITAL INSTRUMENTATION SYSTEMS

The staff has proposed new requirements for digital instrumentation and control (I&C) systems for evolutionary and advanced LWR plants to address potential common-mode failures in digital I&C system software. These new requirements are described in SECY-93-087. This issue is still unresolved on both the ABWR and System 80+ designs, however, progress toward resolution is being made consistent with the staff position.

1. MILESTONE FOR LAST QUARTER

Continue to work with the vendors on this issue and, if necessary, seek and implement guidance from the Commission on this subject.

2. MILESTONES ACCOMPLISHED

After carefully reviewing ACRS, industry, and vendor comments, the staff has developed a final position on this issue which is contained in SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs." The staff's basic recommendations on this issue are the following: (1) the applicant shall assess the defense-in-depth and diversity of the proposed instrumentation and control system to demonstrate that vulnerabilities to common-mode failures have adequately been addressed, (2) the applicant shall analyze each postulated common-mode failure for each event that is evaluated in the accident analysis section of the safety analysis report and demonstrate adequate diversity within the design for each of these events, (3) if a postulated common-mode failure could disable a safety function, then a diverse means, with a documented basis that the diverse means is unlikely to be subject to the same common-mode failure, shall be required to perform either the same function or a different function, and (4) a set of safety-grade displays and controls located in the main control room shall be provided for manual, system-level actuation of critical safety functions and monitoring of parameters that support the safety functions. The displays and controls shall be independent and diverse from the safety computer system identified in items 1 and 3.

In addition, during this quarter, the staff continued to work with GE and ABB-CE on the design specific implementation of this issue.

3. MILESTONES NOT ACCOMPLISHED

None.

4. EFFECT ON SCHEDULE AND RECOVERY

None.

5. MILESTONE PLANNED FOR NEXT QUARTER

Unless the Commission's consideration of the digital instrumentation diversity issue presented in SECY-93-087 changes the staff position, the staff will no longer provide an update on diversity of digital instrumentation systems in

future quarterly reports. Significant design-specific implementation issues will be covered in the project summary section of this report.

D. REGULATORY TREATMENT OF NON-SAFETY SYSTEMS IN PASSIVE REACTOR DESIGNS

Since the design philosophy for the passive advanced light-water reactor departs from current licensing practices, new regulatory and review guidance is needed so that the staff can appropriately review the AP600 and SBWR submittals. This policy issue is being addressed in the staff review of the EPRI passive URD. Delayed resolution of this issue could affect the early review milestones for AP600 and SBWR and the EPRI passive URD FSER.

1. MILESTONES FOR LAST QUARTER

- a. Discuss this issue at the NRC/EPRI senior management meeting in January 1993.
- b. Promptly seek and implement the recommendations of the Commission on this subject.

2. MILESTONES ACCOMPLISHED

Prior to this quarter, the staff met several times with EPRI to determine steps needed to resolve the issue of regulatory treatment of active non-safety systems, and define the scope of requirements and acceptance criteria to ensure that they have adequate capability and availability when required. In a meeting between NRC senior management and the Utility Steering Committee on January 22, 1993, an agreement was reached on an overall process for determining the regulatory treatment of non-safety systems, and the importance of passive systems and/or components for meeting NRC Safety Goals and requirements. On February 23, 1993, EPRI submitted a draft of a proposed process. The staff is reviewing this document. The staff is preparing its position on issues involving the regulatory treatment of non-safety systems and expects to send these positions to the Commission in the next quarter.

3. MILESTONES NOT ACCOMPLISHED

None.

4. EFFECT ON SCHEDULE AND RECOVERY

None.

5. MILESTONES PLANNED FOR NEXT QUARTER

Complete preparation of staff positions on the issues involving the regulatory treatment of non-safety systems in the passive design.

E. NEPA SAMDAs

The staff previously indicated that the resolution of the National Environmental Policy Act Severe Accident Mitigation Design Alternatives (NEPA SAMDAs) may delay the projected review schedules.

1. MILESTONE FOR LAST QUARTER

Continue to work with GE and the industry while reviewing the design alternatives for the ABWR.

2. MILESTONES ACCOMPLISHED

The staff has received GE's response to questions about the 10 CFR 50.34(f) requirements for the ABWR. GE has also submitted the Technical Support Document for the SAMDA review of the ABWR. The staff is reviewing this information. A safety evaluation is currently being prepared that will address the concerns related to consideration of design alternatives identified in 10 CFR 50.34(f)(1)(i). The safety evaluation that considers the 50.34(f) design alternatives will provide much of the basis for the environmental appraisal of the SAMDA issues. The environmental appraisal will be completed concurrently with the development of the proposed design certification rule.

3. MILESTONES NOT ACCOMPLISHED

None.

4. EFFECT ON SCHEDULE AND RECOVERY

None.

5. MILESTONE PLANNED FOR NEXT QUARTER

The staff will no longer provide a separate update on the NEPA SAMDA issue in future quarterly reports unless new policy issues result from the ongoing ABWR review or the initial review of this issue on System 80+ design. Significant design-specific implementation issues will be covered in the project summary section of this report.

III. PROJECT MILESTONES

A. ABWR

1. MILESTONES FOR LAST QUARTER

- a. Develop a revised schedule for ABWR final design approval.
- b. Meet with GE as necessary to resolve open issues identified in the DFSER.
- c. Expedite the resolution of selected system ITAACs for the ABWR with the multi-disciplinary NRR review team.
- d. Receive GE's submittal of the final SSAR to resolve DFSER open issues.
- e. Begin preparation of the FSER.

2. MILESTONES ACCOMPLISHED

During the quarter, the staff focused on three major tasks with respect to the ABWR review. Since nearly half of the DFSER open items were related to ITAAC, the staff formed a multi-disciplinary team to review and resolve selected ABWR ITAAC issues. Section I.A of this report contains a detailed status of ABWR ITAAC issues.

A second major task for the staff was to establish a detailed schedule for completing the ABWR review once a final, certified SSAR and Tier 1 document is received from GE. In SECY-93-041, "Advanced Boiling Water Reactor (ABWR) Review Schedule," the staff provided the Commission with an aggressive review schedule to complete the ABWR review and the underlying assumptions used to develop the schedule.

Because it needed to develop substantial information to address the open issues from the DFSER, GE revised its estimate on when it could submit the certified SSAR and ITAAC. In a letter of March 8, 1993, GE gave July 31 as the submittal date for the final certified SSAR and ITAACs. The staff estimates that it can issue the final design approval for the ABWR approximately nine months from the date of this final submittal.

The third major area of staff activity involved the continuing activities with GE to resolve DFSER open items. These included management meetings, an audit of the ABWR structural design, and numerous telephone conferences and face-to-face meetings to discuss specific review topics.

3. MILESTONES NOT ACCOMPLISHED

Because it needed to develop such a large amount of information on ABWR open issues, GE did not submit the final SSAR as had been anticipated in the last quarterly report. As a consequence, the staff continued to resolve open items and FSER preparation has been extended.

4. EFFECT ON SCHEDULE AND RECOVERY

The schedule given in SECY-93-041 is very aggressive and can only be attained if the ABWR review retains its top priority and GE submits timely, high-quality information on the open and confirmatory items. The schedule leaves no time margin for delays.

5. MILESTONE PLANNED FOR NEXT QUARTER

Continue to pursue resolution of ITAAC issues and DFSER open items.

B. ABB-CE SYSTEM 80+

1. MILESTONES FOR LAST QUARTER

- a. Continue to meet with ABB-CE to discuss and resolve open items identified in the DSER.
- b. Meet with the ACRS on the System 80+ DSER.
- c. Receive submittals from ABB-CE on the DSER open items and ITAACs.

2. MILESTONES ACCOMPLISHED

The DSER for the System 80+ design contained 637 open items and 130 confirmatory items. In early February, ABB-CE completed its responses to the DSER. However, ABB-CE acknowledged that more information is needed to supplement some of its responses. ABB-CE also anticipated submitting a majority of its ITAACs in January. This submittal was delayed in order to incorporate industry review comments and lessons learned from the ABWR ITAAC review efforts and thereby more efficiently use both staff and ABB-CE resources. Section I.A of this report discusses ITAAC issues in more detail.

The staff and ABB-CE continued to work together to resolve DSER open items. Major areas discussed include ITAACs, application of the new source term in calculating offsite

doses for design-basis accidents, and the ABB-CE approach to resolving the interfacing system loss-of-coolant-accident (ISLOCA) issue. The staff and ABB-CE briefed the ACRS on the System 80+ DSER.

3. MILESTONE NOT ACCOMPLISHED

None.

4. EFFECT ON SCHEDULE AND RECOVERY

Delays in the final submittals (especially with regard to ITAACs) in conjunction with the resource impact in a few limited areas (e.g., PRA and severe accidents) associated with staff support of the revised ABWR schedule will delay the System 80+ review schedule. The staff will submit an updated schedule for the System 80+ project in its Commission paper on integrated review schedules for standardized and advanced light-water reactor projects.

5. MILESTONE PLANNED FOR NEXT QUARTER

Continue to work with ABB-CE to resolve DSER open issues.

C. WESTINGHOUSE AP600

1. MILESTONE FOR LAST QUARTER

Continue to review the AP600 application including sending RAIs.

2. MILESTONES ACCOMPLISHED

In December 1992, Westinghouse submitted the information noted as missing or incomplete in the staff's original acceptance review of the AP600 application. As a result, the staff was able to proceed further into the early review stages of the AP600 design.

On February 24, 1993, NRC and Westinghouse senior management met to discuss critical issues affecting the review of the AP600 project. These issues included the regulatory treatment of non-safety systems in the AP600 design, ITAACs, PRA, and the testing program for the AP600.

Other staff activity during the quarter concentrated on two major areas: issuing requests for additional information (RAIs) to Westinghouse and evaluating Westinghouse testing plans for the AP600. Since receiving the AP600 application in June, the staff has issued almost 800 RAIs to Westinghouse. Westinghouse has responded to more than three-fourths of these requests.

Westinghouse plans to complete all testing necessary for the AP600 design by the end of 1993 with the exception of automatic depressurization system (ADS) testing which will be completed in the spring of 1994. The staff met with Westinghouse many times in order to develop a fundamental understanding of both the test program and the facilities at which the testing will take place. In addition, the staff continues to monitor activity at the ROSA-V facility, where NRC confirmatory testing for the AP600 design will take place. Facility modification design work is under way and is expected to be completed in November 1993.

3. MILESTONES NOT ACCOMPLISHED

None.

4. EFFECT ON SCHEDULE AND RECOVERY

The staff's schedule for completing AP600 RAIs as established in SECY-92-294, "Acceptance Review of the Westinghouse Electric Corporation's Application for Final Design Approval and Design Certification for the AP600 Design," is April 1993. The staff will submit an updated schedule for the AP600 project in its Commission paper on integrated review schedules for standardized and advanced light-water reactor projects.

5. MILESTONE PLANNED FOR NEXT QUARTER

Complete issuing RAIs on the AP600 application.

D. SBWR

1. MILESTONES FOR LAST QUARTER

Continue to review the SBWR design, including sending RAIs, if appropriate.

2. MILESTONES ACCOMPLISHED

The staff had previously determined that the SBWR application did not contain all the information required by 10 CFR Part 52. The staff continued its review of the SBWR application material and issued more than 200 RAIs to GE. On March 1, 1993, the staff received GE's supplement to the SBWR application. The staff is reviewing this information to determine if it completes the application. The staff will complete this review early in the next quarter.

3. MILESTONES NOT ACCOMPLISHED

None.

4. EFFECT ON SCHEDULE AND RECOVERY

The staff will establish a formal review schedule for the SBWR design in its Commission paper on integrated review schedules for standardized and advanced light-water reactor projects.

5. MILESTONE PLANNED FOR NEXT QUARTER

Complete acceptance review of the SBWR application, including sending RAls, if appropriate.

E. EPRI UTILITY REQUIREMENTS DOCUMENT FOR PASSIVE REACTORS

1. MILESTONES FOR LAST QUARTER

- a. Pursue resolution of the policy issue on regulatory treatment of non-safety systems.
- b. Continue to review the EPRI response to the DSER and to prepare the FSER.

2. MILESTONES ACCOMPLISHED

During the quarter, staff activity concentrated on developing its final positions on policy, technical, and licensing issues pertaining to evolutionary and advanced light-water designs. The staff prepared SECY-93-087 in which it recommends final positions for Commission approval on 20 issues that are fundamental to the agency's decisions on the acceptability of the evolutionary and passive LWR designs.

In the Commission paper, the staff also discusses 13 issues for which its position is not yet final. These issues involve the following general topic areas: (1) the regulatory treatment of non-safety systems in passive designs, (2) source-term issues for the passive designs, and (3) simplification of offsite emergency planning for the passive designs. The staff expects to develop separate Commission papers on each of these topics in the next quarter.

In addition, the staff continued to pursue resolution of other open items identified in the DSER for the EPRI passive URD.

3. MILESTONES NOT ACCOMPLISHED

None.

4. EFFECT ON SCHEDULE AND RECOVERY

The staff will prepare updated estimates for the completion of the FSER on the EPRI passive URD in its Commission paper on integrated review schedules for standardized and advanced light-water reactor projects.

5. MILESTONES PLANNED FOR NEXT QUARTER

- a. Develop and issue staff positions on the remaining passive plant policy issues.
- b. Continue to prepare the EPRI passive URD FSER.

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