

December 14, 1992

Project Nos. 672, 674, 679, and 680

Jerry D. Griffith, Director
Office of Advanced Reactor Programs
U.S. Department of Energy
NE 45
Washington, DC 20545

Dear Mr. Griffith:

SUBJECT: PROPOSED CHANGES IN PLANS AND SCHEDULES FOR PREAPPLICATION REVIEWS
OF ADVANCED REACTOR AND CANDU 3 DESIGNS

The Nuclear Regulatory Commission was recently informed by James Taylor, Executive Director for Operations, of proposed changes in plans and schedules for conducting preapplication reviews of certain reactor designs. The designs involved include:

- General Atomics 350-MWt Modular High Temperature Gas-Cooled Reactor (MHTGR) design sponsored by the U.S. Department of Energy Gas Cooled Reactor Program
- General Electric 471-MWt Power Reactor Innovative Small Module (PRISM) reactor design sponsored by the DOE Advanced Liquid Metal Reactor Program
- Asea Brown Boveri-Combustion Engineering 2000-MWt Process Inherent Ultimate Safety (PIUS) reactor design
- Atomic Energy of Canada, Limited, Technologies 1378-MWt Canadian Deuterium Natural-Uranium (CANDU 3) reactor design

The proposed schedule changes are shown and discussed in the enclosed Commission paper, SECY-92-393, "Updated Plans and Schedules for the Preapplication Reviews of the Advanced Reactor (MHTGR, PRISM, and PIUS) and CANDU 3 Designs," provided for your information. If you have any questions, please contact Tom Cox at (301) 504-1109.

Sincerely,

Original signed by:
Dennis M. Crutchfield, Associate Director
for Advanced Reactors and License Renewal
Office of Nuclear Reactor Regulation

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SECY-92-393

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POLICY ISSUE **(Information)**

November 23, 1992

SECY-92-393

For: The Commissioners

From: James M. Taylor
Executive Director for Operations

Subject: UPDATED PLANS AND SCHEDULES FOR THE PREAPPLICATION REVIEWS
OF THE ADVANCED REACTOR (MHTGR, PRISM, AND PIUS) AND CANDU 3
DESIGNS

Purpose: To inform the Commission of the staff's current plans and
schedules for conducting preapplication reviews of the
advanced reactor (MHTGR, PRISM, and PIUS) and CANDU 3
designs.

Background: In SECY-91-161, "Schedules for the Advanced Reactor Reviews
and Regulatory Guidance Revisions," the staff informed the
Commission of the following estimates for completion of the
preapplication reviews:

- PRISM November 1992
- MHTGR December 1992
- CANDU 3 June 1993
- PIUS July 1993

The staff based these dates on broad planning assumptions including the preapplicants' design certification application schedules, availability of the Office of Nuclear Reactor Regulation (NRR) resources to conduct the reviews, timely receipt of information to support the reviews, and a scope of review consistent with the previously issued draft preapplication safety evaluation reports (PSERs) for the PRISM and MHTGR designs.

Contacts:
Thomas H. Cox, NRR
504-1109

NOTE: TO BE MADE PUBLICLY AVAILABLE
IN 10 WORKING DAYS FROM THE
DATE OF THIS PAPER

Brian W. Sheron, IES
492-3500

92/202-0093

Subsequent to issuing the estimates in SECY-91-161, a number of factors have necessitated a revision to the schedules for PRISM, MHTGR, CANDU 3, and PIUS preapplication reviews. Some preapplicants have extended their design certification application schedules or modified their proposed designs. Most staff technical review resources have been redirected to higher priority operating reactor and design certification reviews. Additionally, implementation of the Fee Recovery Rule has resulted in preapplicants desiring a preapplication review scope limited to key certification/licensing issues.

In February 1992, the staff issued letters to all four preapplicants requesting confirmation of their plans for design certification and, in some cases, a schedule for submitting additional preapplication review information. All responses were received by May 1992.

During the April 21, 1992, briefing on advanced reactor reviews, the staff advised the Commission that due to other higher priority work, a relatively small number of staff would be dedicated to conduct the preapplication reviews. The staff proposed to concentrate on those key policy issues requiring Commission guidance and revise the preapplication review content and schedule to more effectively use the reduced NRR technical review resources.

In June and July 1992, the staff held public meetings with each preapplicant to discuss the relevant scheduling information, the desired scope of preapplication review, and schedules for additional submittals. The staff also informed the preapplicants of key policy issues that the staff is planning to forward to the Commission for guidance. During these meetings, the preapplicants and the staff agreed on a smaller, more focused scope for conducting the preapplication reviews. Previous planning assumed that the scope of all preapplication reviews would be similar to the scope of the PRISM and MHTGR preapplication reviews documented as NUREG-1368, "Draft Preapplication Safety Evaluation for Power Reactor Inherently Safe Module Liquid Metal Reactor," and NUREG-1338, "Draft Preapplication Safety Evaluation for the Modular High-Temperature Gas-Cooled Reactor."

Discussion:

The staff considered several factors in developing a revised schedule for conducting the preapplication reviews. The enclosure to this paper provides a design-specific summary

of this information and the staff's rationale for sequencing the reviews. Based on this rationale and consideration of available resources, the staff has identified the following revised estimates for completing the preapplication reviews:

- PRISM December 1993
- CANDU 3 December 1994
- PIUS April 1995
- MHTGR December 1995

The staff expects to follow the same review process for approval of the PSERs as is being used for the safety evaluation reports on the evolutionary light-water reactor designs and the Electric Power Research Institute Utilities Requirements Documents. Approximately 6 months before completing the review, the staff will submit a draft final PSER to the Commission. With Commission consent, the staff will forward the draft final PSER to the preapplicant, the Advisory Committee on Reactor Safeguards (ACRS), and the NRC Public Document Room. After considering input during public meetings with ACRS and the preapplicant, a final PSER will be forwarded to the Commission for approval.

The staff intends to conduct most of the preapplication reviews with staff from the NRR Associate Directorate for Advanced Reactors and License Renewal (ADAR), national laboratory technical assistance, and support from the Office of Nuclear Regulatory Research (RES). Due to limited staff resources each design PSER will be developed in a sequential order. NRR technical staff within the Associate Directorate for Technical Assessment (ADT) will, in general, not participate in the preapplication review. ADT technical staff resources are currently required for higher priority operating reactor technical reviews and light-water reactor (LWR) design certification. However, once the draft final PSER has been developed, ADT management will review the report for its policy implications. The staff considers this approach appropriate since the preapplication review considers the conceptual design, and final technical decisions on safety will not be made until the design certification review when the ADT technical staff will be involved.

The staff believes that the changes to the preapplication review scope and schedule, and the approach for conducting NRR technical review, provide the most effective use of NRC resources. The proposed schedules will allow the staff to provide a timely response to the preapplicants in important areas regarding their design certification application plans. By emphasizing the key policy issues for the

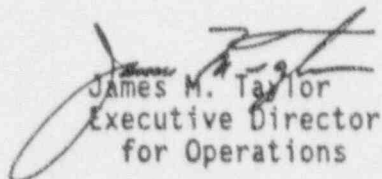
advanced reactor designs, the staff will address the preapplicants' most significant questions about NRC's licensing requirements. Resolution of these issues in the preapplication reviews is expected to allow the preapplicants to reduce the current uncertainty regarding design and design certification schedules.

The staff will continue its assessment of the schedular and resource implications of the reviews for these advanced designs. NRC preapplication review schedules may be altered to support the recent Energy Policy Act of 1992 goals. The status of the preapplicants' plans and the staff's reviews will be provided to the Commission as appropriate.

The staff will, within the next few weeks, submit to the Commission a draft paper on key policy issues affecting the advanced reactor and CANDU 3 designs. Commission guidance on these issues could significantly affect the preapplicants' planning milestones. These issues include proposals by the preapplicants for significant departures from existing regulations and regulatory guidance.

Note:

There has been Congressional interest in this matter and the Chairman previously advised Senator Johnston and Congresswoman Lloyd of the schedules outlined in SECY-91-161. Therefore, the staff plans to submit this paper to the appropriate subcommittees, the Office of Management and Budget, and the Department of Energy.


James M. Taylor
Executive Director
for Operations

Enclosure:
Summary of Input for
Schedule Revision

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PRISM

In March 1989, the NRC issued NUREG-1368, "Draft Preapplication Safety Evaluation Report for Power Reactor Inherently Safe Module Liquid Metal Reactor," in which it summarized the results of its review of the Preliminary Safety Information Document (PSID) submitted in 1986. In March 1990, the U.S. Department of Energy (DOE) submitted Appendix G to the PSID, "Responses to Issues in Draft SER," in which it proposed several significant changes to the PRISM design. These changes included increasing the power, adding an ultimate shutdown system and containment dome, redesigning the reactor to add gas expansion modules (GEMs), and changing to a single-wall-tube helical coil steam generator. Brookhaven National Laboratory (BNL) reviewed the revised design and published its findings in NUREG/CR-5815, "Evaluations of 1990 PRISM Design Revisions." BNL is also reviewing the performance of the GEMs and the consequences of a hypothetical core disruptive accident. The Office of Nuclear Reactor Regulation (NRR) staff is continuing to review the preapplicant's submittals and is writing the final preapplication safety evaluation report (PSER). The Office of Nuclear Regulatory Research (RES) performed the early part of NRC's review and continues to support NRR's work with projects to provide formal documentation for reference in the PSER, to update code validation, to investigate behavior of the new metal fuel, to assess reactivity feedback, and to prepare for source term determination.

In a letter of March 12, 1992, DOE submitted the following schedule:

- | | |
|--|---------|
| • Preliminary Design Approval Application | CY 1995 |
| • Prototype Final Safety Assessment Report | 1997 |
| • Standard Design Certification Application
(After prototype testing) | 2003 |

This schedule appears consistent with the Energy Policy Act of 1992 which established DOE goals for the advanced liquid-metal reactor program to submit a preliminary design approval application to the NRC by September 30, 1996, and to make a decision on prototype demonstration by September 30, 1998.

In June 1992, the National Research Council of the National Academy of Sciences published a report, "Nuclear Power: Technical and Institutional Options for the Future," in which it discussed prerequisites needed to preserve the U.S. nuclear power option and recommended that the Federal government support key reactor designs. The Council recommended that the PRISM design be the only preapplication design to receive government funding because of its unique ability as a breeder reactor.

At a public meeting on July 1, 1992, the NRC staff notified DOE that it would need to delay issuing the PSER beyond the originally scheduled date of November 1992. DOE noted that it had submitted all requested information to the NRC to support the preapplication review and requested that the NRC complete the PSER as soon as possible to support DOE in planning for design certification. DOE recently notified the NRC of problems found with the

reference fuel during testing at the Argonne National Laboratory. DOE indicated it may need to redesign the fuel. The staff does not know how this decision will impact the PRISM design certification schedule.

The staff plans to conduct the PRISM preapplication review first to capitalize on the work already completed and currently in progress. DOE has provided all necessary submittals to support the review and has been responsive to staff questions during the review. DOE's plans for preliminary design approval application in CY 1995 are supported by the National Research Council's recommendation of PRISM as highest priority for DOE support of the four designs in preapplication review. The staff intends to treat the PRISM fuel problem as an open issue in the PSER.

MHTGR

In March 1989, the NRC issued NUREG-1338, "Draft Preapplication Safety Evaluation Report for the Modular High-Temperature Gas-Cooled Reactor," in which it summarized its review of the PSID submitted by DOE in 1986 and 10 subsequent amendments. Responding to the draft PSER, DOE/GA submitted Amendments 11, 12, and 13 to the NRC. These recent amendments provide additional information for NRC's review of the originally proposed design.

NRR is reviewing the submittals on the fuel design and fission product transport analyses at the DOE laboratories. RES performed the early part of NRC's review and continues to support NRR's work with projects to provide formal documentation for reference in the PSER, to evaluate DOE's containment design alternatives, to investigate moisture ingress events, to assess data base adequacies, and to prepare for source term determination.

In its May 18, 1992, response to the NRC letter of February 18, 1992, DOE stated that it would not establish the schedule for the MHTGR design certification until August 1993 when it expected to select the technology for the DOE New Production Reactor (NPR). In September 1992, DOE and the U.S. Department of Defense agreed to defer the NPR program and close the design efforts. The MHTGR schedule depends primarily on the gas-cooled NPR program which technically supports much of the MHTGR design. DOE wants the final PSER issued by April 1993 to support resolution of the key MHTGR policy issues identified in NUREG-1338. DOE asserted that its submittals include all the information needed by the NRC to complete its review for the final PSER. DOE believes that the final PSER is needed in 1993 for the nuclear power industry to understand that the MHTGR is a viable power reactor concept.

The National Research Council report recommended that the commercial MHTGR program be given a low priority for DOE funding because its U.S. market potential was judged to be low. However, the Energy Policy Act of 1992 established DOE goals for the MHTGR program to submit a preliminary design approval application to the NRC by September 30, 1996, and to make a decision on prototype demonstration by September 30, 1998. These new goals may result in a DOE schedule that would require earlier preapplication review of the MHTGR design and resequencing of other design reviews.

DOE has discussed plans to revise the MHTGR design to increase the power of the modules from the current 350 MWt to 450 MWt at the preliminary design approval stage of design certification. It stated that this power increase will not affect the key policy issues for the design. DOE recently informed NRR of problems in testing the reference MHTGR fuel. The preliminary failure rate for the latest test of the MHTGR fuel design is significantly higher than that needed to meet the MHTGR design criteria. DOE expects to complete the post-irradiation examinations in May 1993 at the earliest.

The staff plans to conduct the MHTGR review as the final preapplication review in the series of four projects, because of the uncertainties in the DOE schedule and design to be proposed for design certification application. When DOE submits MHTGR design certification schedules the staff will reconsider the preapplication review plans. DOE is most interested in obtaining feedback on the implementation of the key policy issues for the MHTGR design. Continued emphasis by the staff in obtaining Commission guidance for resolution of the key policy issues will provide DOE valuable feedback on their proposed approach for the MHTGR design in advance of the final PSER.

CANDU 3

On May 2, 1989, Atomic Energy of Canada, Limited, Technologies (AECLT) informed the NRC of its intent to submit the CANDU 3 reactor design for standard design certification. AECLT, a wholly owned U.S. subsidiary of Atomic Energy of Canada, Limited, (AECL) in Canada, has supported the CANDU 3 preapplication review by submitting a Technical Description, Conceptual Safety Report, Conceptual Probabilistic Safety Assessment, and several technology transfer reports describing the CANDU design.

In a letter of March 18, 1992, AECLT informed the NRC that it could support a standard design certification application in 1995 or 1996 if the NRC completed its preapplication review of the CANDU 3 by June 1993. On June 29, 1992, AECLT gave the staff a schedule of submittals to support the preapplication review. AECL has completed much of the final design work for the CANDU 3 reactor and is negotiating to start construction in a Canadian province which could serve as a prototype for the CANDU 3 design certification in the U.S. In September 1992, AECL acknowledged that it would re-evaluate its design certification plans in the U.S. if Canadian construction plans did not materialize.

The National Research Council report identified the CANDU 3 design as a mature design that could be licensed this century. The report noted that the licensing process could be lengthy because of the difference in regulatory requirements between the U.S. and Canada. The Council did not find sufficient advantages with the design to justify DOE support for design certification.

The staff has started some preapplication review on the CANDU 3 design. NRR is conducting two projects at DOE laboratories: a study of the CANDU 3 positive void reactivity coefficient and a review of the operation of the on-line refueling machine. RES has completed a systems study to identify candidate event sequences for required safety analysis, and it has projects to assess data base adequacies, to perform preliminary transient calculations

using Canadian codes, to identify code needs for future independent analyses, to initiate severe accident analyses with NRC codes, and to prepare for source term determination. RES will also provide in-house analytical capabilities for itself and NRR for the CANDU 3 design.

To better understand the CANDU 3 containment performance and radiological releases, NRR is reviewing the consequences of a large break loss-of-coolant accident (LOCA) with a failure to shut down. NRR is performing this work to support the Commission's decision on a key policy issue: the acceptability of a design with a dominant positive void coefficient. The preapplicant has not performed this analysis for CANDU 3, and has supplied little directly relevant information on the event and its consequences.

AECLT is having problems getting proprietary information released from Canada to the U.S. This has delayed the staff in obtaining Canadian codes thus interrupting RES's work to use these codes for preliminary calculations. Code work is now on the critical path for completing the preapplication review, and the lack of timely submittals of other proprietary information could further delay the review schedule. In a letter dated September 23, 1992, the staff informed AECLT that an inability to transfer proprietary material to the U.S. may affect the proposed CANDU 3 preapplication review schedule. AECLT is now pursuing transfer of proprietary material directly from AECL to the NRC.

The staff plans to conduct the CANDU 3 review as the second preapplication review because the design and experimental data base are already sufficiently developed to support the review. The June 1994 PSER issuance assumes prompt resolution of the present problems releasing proprietary information required for the review from Canada to the United States.

PIUS

In October 1989, Asea Brown Boveri (ABB) Atom requested that the NRC perform a licensability review of its Process Inherent Ultimate Safety (PIUS) plant design. ABB Combustion Engineering (ABB/CE) of Windsor, Connecticut, is the direct representative of ABB Atom in the U.S., and is the official preapplicant of record.

In May 1990, ABB/CE submitted a five volume Preliminary Safety Information Document (PSID) to support its request for a preapplication review. NRR has started a project with BNL to support core neutronics modeling. RES has completed a systems study to identify candidate event sequences for required safety analysis, and it has projects to assess data base adequacies, to perform preliminary transient calculations using the existing TRAC code, to identify code needs for future independent analyses, to initiate severe accident analyses with NRC codes, and to prepare for source term determination. RES will also provide in-house analytical capabilities for itself and NRR for the PIUS design.

In a letter of April 22, 1992, ABB stated that it would submit a design certification application in 1994 or 1995 if (1) the NRC issues a preapplication safety evaluation report (PSER) by April 1994 that does not require

significant design changes to the PIUS design, and (2) the commercial environment at that time is favorable to that decision. ABB is negotiating with the Italian state utility to support testing of the PIUS design and will give the NRC details of its overall test plan when the basic negotiations are complete.

During an August 6, 1992, meeting, ABB informed the staff of a proposed change to the PIUS design. The design change involves adding four "scram valves" and associated piping. The feed lines to these valves take suction from the boroated reactor pool water, and the valves discharge to the suction of each of the four reactor coolant pumps. Activating the valves is expected to result in a rapid and uniform insertion of boron by a means redundant and diverse from the passive scram process. The passive scram through the density locks will still be the ultimate shutdown process. ABB plans to submit the design change in a November 1992 supplement to the PSID. ABB also plans to submit a PRA supplement in early 1993 for the PIUS design.

The National Research Council report concluded that the PIUS design would not likely be ready for commercial operation within the next 20 years and had a low priority for DOE support. The lack of operation and regulatory experience is expected to delay acceptance by utilities of this advanced LWR design.

The staff plans to conduct the PIUS review as the third preapplication review because the design is presently at the conceptual stage and the experimental data base for the design is still being developed. ABB is most interested in obtaining feedback on the implementation of the key policy issues for the PIUS design. Continued emphasis by the staff in obtaining Commission guidance for resolution of these issues will provide ABB feedback in advance of the final PSER. Conducting the PIUS review third will allow ABB time to develop the design more fully and respond to staff questions without impacting the preapplication review schedule.