



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
Nuclear Safety Research Review Committee  
Washington, D.C. 20555

December 5, 1994

Mr. Eric S. Beckjord, Director  
Office of Nuclear Regulatory Research  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555

Dear Mr. Beckjord:

At your request, the Nuclear Safety Research Review Committee met on November 7-8, 1994, at NRC Headquarters, to review current plans for confirmatory research in support of certification review of the CANDU 3 nuclear power plant design. This is a report of that meeting.

The NRC received an application from AECLT in September 1994 to license the CANDU 3 design for construction and operation within the U.S. The application was, at NSRRC meeting time, in the 60-day acceptance review process. If the application is accepted, a limited review effort by NRR is planned this FY 95, with research activity not scheduled to begin until FY 96.

The Committee benefitted from presentations by representatives of the applicant, AECLT, describing the design and research base of the CANDU 3 reactor plant, as well as presentations by the NRC staff of information on preliminary planning by RES on the research support RES believes necessary to provide the basis for licensing decisions by the USNRC. Informative material provided in advance of the meeting was helpful as well.

Although more than 25 CANDU reactors are operating worldwide, the CANDU 3 design has a number of features different from plants now operating or under construction. That aspect is requiring additional review and research by the AECB, the Canadian regulatory organization. Of course, AECL and Canadian utilities have conducted an extensive long-term research program on CANDU reactors. The NSRRC estimates that that effort represents very roughly one half the total effort which has gone into safety research of LWR's in the US, and one quarter the total world research in LWR safety.

The Committee recognizes that it is too early in the NRC's consideration of the CANDU 3 licensing process to arrive at definitive plans for supporting research, and therefore it was not possible in the time available to arrive at detailed comments on RES research plans for CANDU 3. Nevertheless, the Committee concluded its limited review with the following general, preliminary conclusions:

- I. There does not appear to be a considered existing plan describing how to approach licensing a new reactor concept. Rather, after decades of researching, analyzing and regulating LWR's, the NRC appears to be feeling its way into a significantly different field of responsibility, rather than attempting to define in advance the principles it should follow to license a new reactor concept. Perhaps that is inevitable,

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but some attempt to describe at a high organizational level the principles to be followed would be useful in the early stages of the CANDU 3 process.

Two major questions arise: 1) To what degree can Canadian research be accepted outright without confirmatory research in the U.S.? Present plans by RES appear to include analytical research only, not experimental research, to confirm Canadian designs, although there is some thought of limited use of Canadian test facilities to satisfy NRC experimental needs. 2) To what degree should RES provide support in areas in which CANDU 3 differs from U.S. experience, and even from previous CANDU experience? For example, CANDU 3 will be to a far greater degree controlled by automated systems than past U.S. practice. Further, we have been informed that it has a positive void coefficient of reactivity under some conditions. The planned RES program proposes only modest research effort specifically on these subjects.

- II. The estimated cost of the RES plan for CANDU 3 research is \$18 million over 5 years. That amount of effort seems quite modest as compared with the past and present programs on U.S. LWRs. Of course, some LWR research on fuel, heat transfer, hydraulics and source term is applicable to CANDU 3, but there are major differences in physics, pressure boundary materials, refueling systems and shutdown systems, in which there is little applicability of U.S. research.
- III. The balance among the research areas of the RES planned effort does not seem appropriate to the NSRRC. The most significant amount by far (\$7 million) is planned for thermal hydraulic code development, while less than \$1 million is planned for reactor physics and \$3 million for severe accidents research. In the area of thermal hydraulic codes, RES has decided it should rewrite the relevant codes in U.S. laboratories rather than depend on modification of existing Canadian codes, although there is some thought that less U.S. effort would be needed if some of the proprietary restrictions on Canadian codes were relaxed.
- IV. While recognizing our lack of familiarity with CANDU technology and the limitations of a two-day review of the broad subject so early in the NRC's activities on CANDU 3, the NSRRC has several recommendations to RES. Actions have been initiated on these recommended areas but the NSRRC encourages early more aggressive efforts.
  - 1) Look once more at the fundamental licensing issues -- positive void coefficient; computerized distributed digital control; on-line refueling -- and determine whether Canadian research results plus what is planned in the U.S. will provide a fully sufficient base for licensing by the USNRC.
  - 2) Decide soon whether structural and seismic codes and standards, as proposed by AECLT, will be acceptable to the NRC in areas such as primary system piping and zirconium

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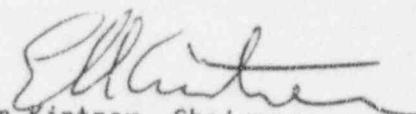
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pressure tubes. Existing ASME codes do not address several such areas, and it appears that CANDU designs do not meet some U.S. requirements for access and non-destructive testing.

- 3) Establish closer contact with the AECB to exchange views on safety features and research requirements as well as to more fully understand the prior and current regulatory actions on CANDU concepts in general and CANDU 3 in particular. (A meeting of NRC senior managers with the AECB is planned for December 13.)

RES has carried out a preliminary review of these aspects, but the NSRRC concludes that the CANDU 3 design is so different from that of U.S. LWRs, that a more detailed understanding of the design by the NRC must be obtained, and a more detailed analysis made of the research needs to fully support licensing of the new design. In fact, such an analysis will necessarily be a continuing process as the licensing proceeds.

Sincerely,



Edwin Kintner, Chairman  
Nuclear Safety Research Review Committee