May 13, 2003

Mr. Vince Langman
ACR Licensing Manager
Atomic Energy of Canada Limited (AECL) Technology, Inc.
481 North Frederick Avenue, Suite 405
Gaithersburg, Maryland 20877

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION - ACR-700 PRE-APPLICATION REVIEW (TAC NO. MB5765)

Dear Mr. Langman:

Atomic Energy of Canada Limited (AECL) submitted a formal request for a pre-application review of the Advanced CANDU Reactor (ACR-700) design on June 19, 2002.

The Nuclear Regulatory Commission (NRC) staff is reviewing technical information provided by AECL as part of the ongoing pre-application review activities for the ACR-700 design. The NRC staff has determined that additional information is necessary to continue the review. The requests for additional information (RAIs) are included in the enclosure. The topics covered in these RAIs include: the reactor neutronics review, the assessment of the negative void reactivity, and the ACR technology base. An advanced copy of the RAIs were sent to you via electronic mail on March 10, 2003. On April 1, 2003, AECL participated in a teleconference with the staff to discuss the content of the RAIs and agreed to provide two documents containing most of the ACR-700 information requested in the RAIs. On April 25, 2003, AECL participated in a second teleconference with the staff to clarify the RAIs and agree on the due date. AECL stated that they would provide the two documents containing relevant ACR information in advance of the official response to the RAIs as well as the set of neutronics computer codes used in the ACR-700 design. AECL's response to the RAIs is expected by June 15, 2003, with the exception of the set of neutronics computer codes which is expected no later than August 30, 2003, as agreed upon during the teleconference of April 25, 2003.

If you have any questions or comments concerning this matter, you may contact the undersigned at (301) 415-2375 or bxs2@nrc.gov.

Sincerely,

/RA/

Belkys Sosa, Project Manager
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation

Project No. 722

Enclosure: As stated

cc: See next page

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Requests for Additional Information (RAIs)
ACR-700 Pre-Application Review

In the context of its ongoing pre-application review activities for the ACR-700 design, the Nuclear Regulatory Commission (NRC) staff plans to perform an initial independent analysis of the predicted reactivity effects from operational and transient changes in the temperatures, densities, and compositions of fuel, coolant, and moderator. These planned analysis activities will support the staff's efforts on some of the pre-application focus topics requested in Enclosure 1 of AECL's letter 108US-01321-021-001, dated December 18, 2002. Specific pre-application focus topics to be served by the planned analysis include: Confirmation of Negative Void Reactivity, Computer Codes and Validation Adequacy, and ACR Technology Base.

The staff's analysis efforts in this area will require that detailed information be provided on the fuel elements, fuel bundles, fuel channels, core configurations, and operating conditions in the ACR-700 design. Specific information needs for the ACR-700 include:

1. Fresh fuel pellet dimensions, densities, compositions, and temperatures:

    a. Dimensions and densities of fresh fuel pellets and pellet stacks.

    b. Initial fuel compositions, including the U^{235} content and the composition of any burnable poisons.

    c. As a function of burnup (i.e., with representative burnup histories and powers), the predicted inventories of all neutronically significant nuclides, including actinides (U, Np, Pu, Am, etc.), fission products (Xe, Sm, Rh, Ag, etc.), and any burnable poisons.

    d. Predicted average fuel pellet temperature.

2. Configurations, compositions, and densities of the fuel element structures, including the following as functions of relevant conditions:

    a. Thickness, outer radius, and length of fuel sheaths (i.e., cladding).

    b. Length and radius of fuel end caps.

    c. Locations, lengths, widths, and heights of all fuel element spacer buttons, bearing pads, flow enhancing buttons, etc.

3. Configurations, compositions, and densities of the fuel bundle structures, including the following as functions of relevant conditions (e.g., temperatures, fluences):

    a. Radii of the fuel element rings.

    b. Azimuthal positioning of the fuel elements within the rings.

    c. Overall length of fuel bundle.

d. End plate geometry with dimensions.

4. Fuel element exposures and power distributions within the fuel bundles.

5. Configurations, dimensions, compositions, and densities of the pressure tubes and calandria tubes, as built:

   a. Inner radii and thicknesses of the pressure tubes and calandria tubes.

6. Configurations, dimensions, compositions, and densities of all reactivity devices, core instrumentation, and other structures in the core, including:

   a. The mechanical zone-control units, and the guide tubes of the reactivity devices in the core.

7. Core average configurations, compositions, and densities, including the following under relevant conditions (e.g., startup, power operation, load follow, postulated transients, shutdown):

   a. Number, configuration, and pitch of fuel channels.

   b. Average coolant temperature, pressure, and density.

   c. Gas gap compositions, temperatures, and densities.

   d. Moderator core average temperature, pressure, and density.

   e. Nominal moderator purity.

   f. Locations and representative positioning of all reactivity devices.

8. Representative core-wide fuel bundle exposure and power maps, including the “ripple” effects from online refueling.

9. Configuration, composition, and densities of the calandria tank and shield tank, including:

   a. Tank dimensions, wall thicknesses, and compositions.

   b. Composition, temperatures, pressures, and densities of shield tank contents.

10. Dimensions, compositions, and densities of the neutronically significant reactor materials, components, and systems indicated above.

11. Input specifications and analyzed results from AECL calculations with WIMS/RFSP on ACR core calculations.

12. The set of neutronics computer codes used in the ACR-700 design, such as WIMS-AECL, DRAGON-IST, and RFSP-IST. The response should include the executable, source decks and input files for each code as well as the user's manuals, theory manual, and validation manual for DRAGON.

It is recognized that the following information may not be currently available and it should be provided separately by AECL, when available, but during the ACR-700 pre-application phase:

13. Input specifications and analyzed results from AECL calculations with MCNP on representative ACR core lattices.

14. Data from the benchmark experiments (e.g., ZED-2 measurements) used for evaluating biases and uncertainties in the computed predictions of reactivity feedbacks and other neutronic phenomena in the ACR-700.

The information requested should be provided in appropriate printed and/or electronic formats, which may include text, tabulations, graphs, charts, sketches, diagrams, engineering drawings, CAD documents, spreadsheets, and/or data bases.

ACR-700

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