

November 24, 2003

Our File: 108US-01321-021-001  
Your File: Project No. 722

U.S. Nuclear Regulatory Commission,  
Document Control Desk,  
Washington, D.C. 20555

Attention: Ms. B. Sosa  
Project Manager, ACR

Reference:

1. E-mail B. Sosa to V. Langman, "Requests for Additional Information (RAIs) #2 - Advanced Copy", September 11, 2003.
2. E-mail J. Kim to V. Langman, September 24, 2003.
3. Letter V. Langman to B. Sosa, "'A Phenomenology-Based Matrix of Tests for Use in Validation of Thermalhydraulics Codes Employed in CANDU Safety Analysis", Proprietary Report in Support of the ACR Pre-Application Review", July 21, 2003.
4. Letter V. Langman to B. Sosa, "CANDU Physics Validation Matrix", October 17, 2003.
5. Letter V. Langman to B. Sosa, "Database of CANDU Thermal Hydraulic Experiments for Code Validation", July 09, 2003.

Dear Ms. Sosa,

**Re: Response to NRC's Requests for Additional Information (RAIs) #2**

Following an NRC's request (References 1 and 2) and in support of the NRC's pre-application review of the ACR (i.e., specifically focus topic # 3 - Computer Codes and Validation Adequacy and focus topic # 12 - ACR Technology Base), attachment 1 provides AECL's responses to NRC staff requests for additional information and attachment 2 lists the support information and documentation that is enclosed with this letter.

The data and information included in Attachments 1 and 2 and in the enclosed package are proprietary information of the type that AECL normally maintains in confidence and withholds from public disclosure. The information has been handled and classified as proprietary to AECL as cited in the affidavit provided in Attachment 3. Therefore, it is requested that the AECL proprietary information contained on the enclosed CDs and documents, be handled by the USNRC on a confidential basis and be withheld, in their entirety, from public disclosure in accordance with the provisions of 10CFR2.790 and 9.17.

D070



If you have any questions on this letter and/or the enclosed training material please contact the undersigned at (905) 823-9060 extension 6543.

Yours sincerely,

A handwritten signature in cursive script that reads "Vince Langman". A horizontal line is drawn under the signature to the right.

Vince J. Langman  
ACR Licensing Manager

**/Attachments:**

1. Response to Requests for Additional Information (RAIs) #2 from NRC (Thermal Hydraulics Questions)
2. List of Enclosures in Response to RAI #2
3. AECL Proprietary Information Affidavit

**/Enclosures:**

The enclosures listed in attachment 2 of this letter were sent to Belkys Sosa, ACR Project Manager, with a separate cover.

**Attachment 1**

(Letter V. Langman to B. Sosa, "Response to NRC's Requests for Additional Information (RAIs) #2, November 24, 2003)

**Response to NRC's Requests for Additional Information (RAIs) #2**  
**ACR-700 Pre-Application Review**

Highlights of a telecon between AECL and the NRC to discuss the NRC questions (September 25, 2003), along with AECL's responses to these questions are provided in italic fonts following each of the NRC's questions. These comments and responses are based on what was discussed on these RAIs between NRC staff and AECL staff during a conference call.

15. ACR-700 or other CANDU PIRT (phenomena identification and ranking table) upon which the scaling is based.
  - *The original scaling for RD-14M was performed in the mid 1980's and pre-dates the formulation and application of the PIRT process; the enclosed CD titled "Documentation in Support of AECL's Response to NRC's RAIs #2" contains the paper "Scaling Laws for Simulating the CANDU Heat Transport System", presented at the Summer Computer Simulation Conference, Montreal, Canada, July 1987;*
  - *A PIRT-like process was applied in the mid-to-late 1990's when the Canadian nuclear industry compiled a series of technical discipline based validation matrices in support of formal computer code validation;*
  - *As a result, key phenomena are listed in the CANDU Validation Matrices. NRC have received the thermal hydraulics validation matrix (Reference 3) and the physics validation matrix (Reference 4). For fuel and fuel channel validation matrix, we enclose the AECL Report RC-1773, "A Phenomenology-Based Matrix of Tests for use in the Validation of Fuel and Fuel Channel Thermal-Mechanical Behaviour Codes Employed in CANDU Safety Analysis", Revision 1, July 1998. AECL does not expect any new phenomena due to the slightly different ACR conditions.*
  
16. Single channel and multiple channel experiments done at Stern Labs.
  - *NRC are looking for data on heat transfer and flow regime experiments;*
  - *NRC agreed to look at the thermal hydraulics electronic database (Reference 5), and get back to AECL with specific test data requests;*
  - *AECL offered to send a person to the NRC offices to expedite interface/interrogation of the electronic database;*
  - *Action with NRC staff.*

- 
17. Small and large scale pump behavior tests done with two phase inlet conditions (if available).
    - *RD-14 small scale: Enclosed Report CWAPD-421, "Steady Two-Phase Flow Performance Characteristics of the RD-14 Loop Primary Heat Transport Pump", May 1984, (hardcopy);*
    - *Ontario Power Generation large scale: Enclosed Report COG-95-546, "Experimental Study of Full- and Model-Scale CANDU Reactor Pumps under Steam-Water Two-Phase Flow Conditions", September 1997, (hardcopy);*
    - *Enclosed CD titled "Pump Data Files" contains data regarding the small and large scale pump tests.*
  
  18. Experiments to look at CCFL in feeder tube and elbow arrangement.
    - *The enclosed report "Countercurrent Steam/Water Flow in an Upright 90° Elbow", AECL Report CANDEV-85-11, March 1986, describes the tests performed to measure the counter-current flow in an upright 90° elbow. These tests are referred to as tests ID No. SE3 in the Thermal Hydraulics Validation Matrix that was sent with Reference 3.*
  
  19. Experimental results on hydrodynamic forces and propagation of pressure tube and feeder breaks.
    - *A PIRT exercise on channel flow blockage is currently being performed by AECL and is expected to be finalized in Spring 2004. Potential mechanisms for propagation of pressure tube failures are being considered in this PIRT exercise.*
  
  20. Scaling reports or papers for RD-14, RD-14M, and RD-14/ACR, and for other separate effects/component tests mentioned here. Discussion of local scaling and design approaches including flow regime transitions, geometric distortions, local volume distortions, local flow path distortions, heat transfer area distortions, heat flux distortions, volume versus elevation. Both top down and bottom up analysis should be included to the extent available. Discussion of structural heat sources and heat sinks. Discussion of parametric ranges covered in the experiment should be discussed and compared to expected plant ranges.
    - *The enclosed CD titled "Documentation in Support of AECL's Response to NRC's RAIs #2" contains a paper on past RD-14M scaling, i.e., "Scaling Laws for Simulating the CANDU Heat Transport System", presented at the Summer Computer Simulation Conference, Montreal, Canada, July 1987;*
    - *TH information on RD-14 (full size channel) and RD-14M (multiple channels) are available in the thermal hydraulic electronic database (Reference 5);*
    - *AECL is currently addressing RD-14M scaling using more advanced techniques. A report will be available in Fall 2004.*

- 
21. Each known distortion should be discussed with respect to its effect on experiments and its relevance to the prototype. Two techniques of identifying facility distortions are:
- Identify from evaluating the facility with respect to highly ranked phenomena from the PIRT and from examination of the experimental results; and
  - Identify from considering the geometrical and scaling design compromises in the facility.
- AECL is currently addressing RD-14M scaling using more advanced techniques. A report will be available in Fall 2004.*
22. Test matrix rationale (e.g. break size, break location, transients, parametric ranges).
- Test matrix rationale is included in the thermal hydraulics electronic database, which was provided with Reference 5.*
  - The enclosed CD titled "Documentation in Support of AECL's Response to NRC's RAIs #2" contains the ACR Large LOCA test plan report "RD-14M/ACR LOCA Test Plan", AECL Report 108-126410-440-001, Revision 0, August 2002.*

Facility design information for input model development

The staff is using RELAP for audit calculations during the pre-application review of the ACR-700 but will switch to TRACE during design certification to assess the ACR-700 design. To facilitate TRACE code development in time to support ACR design certification, we recommend AECL Technologies provide the following information at this time:

23. Facility drawings and descriptions for the CWIT. A detailed facility description should be provided including its isometric layout, insulation, and heat tracing. CATHENA input model, and notebook documenting the model for the CWIT.
- Enclosed COG Report COG-96-255, "Description of the Cold Water Injection Test Facility", May 1998, (hardcopy), provides the CWIT facility detailed description;*
  - Enclosed COG Report COG-94-591, "CATHENA Idealization - Documentation of the Cold Water Injection Test (CWIT) Facility", Revision 0, April 1997, (hardcopy) provides the CATHENA idealization for CWIT;*
  - Enclosed CD titled "CWIT Related Information provides the CATHENA input model for CWIT.*
24. Facility drawings and descriptions for Stern Lab and other rod bundle channel tests that have been used for heater transfer/flow regime studies to support CATHENA development, validation or assessment.
- See response to item # 23 (the CWIT facility was constructed at Stern Laboratories Inc. in mid-1970's).*
25. Facility drawings and descriptions for the header test facilities. This includes the Large Scale Header Facility and other header tests used for CATHENA development, validation or assessment.
- See response to item # 26 below.*

- 
26. Complete description of instrumentation type, location, and accuracy for each facility.
    - *Enclosed CD titled "Documentation in Support of AECL's Response to NRC's RAIs #2" contains the COG Report COG-00-034-R1, "RD-14M Facility Description and Characterization", April 2003;*
    - *Enclosed COG Report COG-95-101, "Description of the Large-Scale Header Facility", Volumes 1-4, 1999, (hardcopy);*
    - *Enclosed COG Report COG-96-255, "Description of the Cold Water Injection Test Facility", May 1998, (hardcopy).*
  
  27. Facility operating procedures.
    - *The operating procedures are provided for each facility and each test in the Thermal Hydraulic Database submitted to the NRC (Reference 5).*
  
  28. Results from facility characterization tests, including available measurements of facility heat loss and heat loss distribution, and pressure drops throughout the loops. A representative test report with initial and boundary conditions (e.g. injection rate) will be needed to initialize the model.
    - *See response to item # 31 below.*
  
  29. Calculated CATHENA results and experimental data from at least one RD-14M header break experiment, in electronic form.
    - *See response to item # 31 below.*

The information requested above 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. Please note that the staff is currently reviewing the following information:

- CATHENA input manual.
  - CATHENA input model and notebook for ACR-700.
  - CATHENA input model for RD-14M.
  - RD-14M Facility Description and Characterization for the ACR Configuration, DP. Byskal, R.S Swartz, March 2003.
30. Please provide the calculational notebook documenting the RD-14M CATHENA model.
    - *See response to item # 31 below.*

31. The NRC Staff was provided with a report titled "RD-14M Facility Description and Characterization for the ACR Configuration 108-126410-470-Revision R0," Edited by D.P. Byskal and R.S. Swartz. This report includes only components which were modified for the ACR configuration. We were provided with a CATHENA input deck for RD-14M Test B9401. Please provide a description of the RD-14M facility as it was configured for Test B9401.
- *Response to items # 28-31: The enclosed CD titled "B9401-Related Information" contains the CATHENA input and output (results) files for the large break RD-14M header experiment B9401. It also contains a spreadsheet of key experimental data for the B9401 experiment. The COG report COG-89-123, "CATHENA Idealization – Documentation of the RD-14M Facility", Revision 1.0, November 1997, is also included on the CD and describes the CATHENA idealization for the test.*
32. Please provide an RD-14M CATHENA deck as it is configured for ACR-700 tests and the corresponding calculational notebook.
- *The enclosed CD titled "RD-14/ACR Idealization - Test B0202" contains the CATHENA input file for ACR-700 test B0202;*
  - *The CATHENA idealization documentation of the RD-14/ACR facility will be available in March 2004.*

**Attachment 2**

(Letter V. Langman to B. Sosa, "Response to NRC's Requests for Additional Information (RAIs) #2, November 24, 2003)

**List of Enclosures in Response to RAI#2**

Documentation	Media	In response to item #
Paper "Scaling Laws for Simulating the CANDU Heat Transport System", July 1987. (Non-Proprietary)	CD titled "Documentation in Support of AECL's Response to NRC's RAIs #2"	15, 20
AECL Report "A Phenomenology-Based Matrix of Tests for use in the Validation of Fuel and Fuel Channel Thermal-Mechanical Behaviour Codes Employed in CANDU Safety Analysis", RC-1773, Revision 1, July 1998.	Hardcopy	15
Report "Steady Two-Phase Flow Performance Characteristics of the RD-14 Loop Primary Heat Transport Pump", CWAPD-421, May 1984.	Hardcopy	17
Report "Experimental Study of Full- and Model-Scale CANDU Reactor Pumps under Steam-Water Two-Phase Flow Conditions", COG-95-546, September 1997.	Hardcopy	17
Pump test files: <i>Pump data files.txt</i> <i>Homol4.dat</i> <i>Meas14.dat</i> <i>Pp2pcog.xls</i> <i>Rd14.dat</i> <i>Rd14.raw</i> <i>Rd14_15.dat</i> <i>Rd14_45.dat</i> <i>Rd14_90.dat</i> <i>RD14pump.xls</i>	CD titled "Pump Data Files"	17
Report "Countercurrent Steam/Water Flow in an Upright 90° Elbow", AECL Report CANDEV-85-11, March 1986	Hardcopy	18
Report "RD-14M/ACR LOCA Test Plan", 108-126410-440-001, Revision 0, August 2002.	CD titled "Documentation in Support of AECL's Response to NRC's RAIs #2"	22
Report "Description of the Cold Water Injection Test Facility", COG-96-255, May 1998.	Hardcopy	23, 24, 25, 26



Documentation	Media	In response to item #
Report "CATHENA Idealization - Documentation of the Cold Water Injection Test (CWIT)", COG-94-591, Revision 0, April 1997.	Hardcopy	23, 24
CATHENA files re CWIT experiment: <i>CWIT Read_Me.txt</i> <i>cw1598.inp</i> <i>B10PT6_w.DAT</i> <i>B10pt6.asc</i> <i>98inp1.dat</i> <i>98inp2.dat</i> <i>98inp4.dat</i> <i>B10pt6_u.dat</i>	CD titled "CWIT Related Information"	23, 24
Report "RD-14M Facility Description and Characterization", COG-00-034-R1, April 2003;	CD titled "Documentation in Support of AECL's Response to NRC's RAIs #2"	25, 26
Enclosed COG Report COG-95-101, "Description of the Large-Scale Header Facility", Volumes 1-4, 1999;	Hardcopy	25, 26
B9401 test files: <i>RD-14M Read_Me.txt</i> <i>B9401.inp</i> <i>DJR_TOTAL.OUT</i> <i>RD-14M Data.xls</i>	CD titled "B9401-Related Information"	28-31
Report "CATHENA Idealization - Documentation of the RD-14M Facility", COG-89-123, Revision 1.0, November 1997;	CD titled "B9401-Related Information"	28-31
CATHENA input file for RD-14/ACR test B0202: <i>B0202.inp</i>	CD titled "RD-14/ACR Idealization - Test B0202"	32



---

ATTACHMENT 3

APPLICATION FOR THE NUCLEAR REGULATORY COMMISSION'S WITHHOLDING  
FROM PUBLIC DISCLOSURE  
OF PROPRIETARY AECL REPORTS

10 C.F.R. § 2.790  
AFFIDAVIT OF KEN HEDGES


I, Ken Hedges, Vice-President, Technology, AECL Technologies Inc., do hereby affirm and state:

1. I am the Vice-President, Technology for AECL Technologies Inc., and have been delegated the function of reviewing the proprietary information sought to be withheld from public disclosure, and am authorized to apply for its withholding on behalf of AECL Technologies Inc.
2. In the attached letter B. Sosa from V. Langman, "Response to NRC's Requests for Additional Information (RAIs) #2", dated November 24, 2003, the attachment 1 and the enclosures listed in Attachment 2 of that letter, AECL Technologies Inc. is providing information in support of the Nuclear Regulatory Commission's (NRC) pre-application review of the Advanced CANDU Reactor (ACR). The information provided constitutes proprietary commercial information that should be held in confidence by NRC pursuant to 10 CFR §§ 2.790(a)(4) and 9.17(a)(4), because of one, or more, of the following reasons:
  - i. This information is confidential and has been held in confidence by AECL, which is the parent company of AECL Technologies Inc. The information is contained in AECL reports or other documents that are normally held in confidence in accordance with AECL's procedures for the protection of information. The reports or other documents are part of AECL's comprehensive safety and technology base for the CANDU design, and their commercial value extends beyond the original development costs, which in themselves are considerable.
  - ii. The information is contained in CANDU Owners Group Inc. (COG) reports that are held in confidence by both AECL and the Canadian nuclear utilities that participate in research and development programs via COG. There is a rational basis for holding the reports in confidence since the information contains sensitive technical and/or commercial information relating to the supporting research, design and/or operation of CANDU reactors. Also, COG reports are only distributed to participants in COG research and development programs. These participants expend significant amounts of money to fund the COG research and development programs, which produce the information described in these reports. Additionally, public disclosure by the NRC of the information contained in COG reports, which are supplied in confidence by COG to AECL, could jeopardize the future availability of such information to AECL.

AECL is contractually obligated to COG and to other participants in COG programs to maintain the confidentiality of such reports. AECL relies, in part, on COG reports to improve the safety, operability and maintainability of the ACR, and to help develop and recommend improvements to enhance the safety, operability and maintainability of existing CANDU plants. COG would be reluctant to provide such information to AECL, and could move to restrict AECL Technologies' ability to provide such reports to the NRC, if there was a possibility that the NRC might make the information publicly available, after being supplied to the NRC by AECL Technologies Inc. AECL would suffer harm to its commercial business and competitive position if it did not have access to these reports and was unable to improve existing and future designs. Further, other participants in COG research and development programs would be reluctant to enter into such programs in which AECL was a participant; those participants enter into and fund such programs with the expectation that the results will remain confidential to COG and program participants; if there is a possibility that information generated in such programs would become publicly available through AECL Technologies' provision of COG reports to the NRC, they will not wish to participate in research programs with AECL. For the same reason, disclosure of such reports by the NRC would also hinder the ability of the NRC to receive similar reports in the future from AECL Technologies, since COG would likely withhold such reports from AECL.

- iii. This information is being transmitted to the NRC in confidence.
- iv. This information is generally not available in public sources and could not be gathered readily from other publicly available information.
- v. Public disclosure of this information would create substantial harm to the competitive position of AECL by disclosing sensitive commercial information about the design and/or operation of CANDU reactors and/or the ACR to other parties whose commercial interests may be adverse to those of AECL. Also, the information contained in these reports has been developed at significant cost to AECL (the parent company of AECL Technologies).

3. Accordingly, AECL Technologies Inc. requests that the information provided in Enclosure 1 be withheld from public disclosure pursuant to the policy reflected in §§ 2.790(a)(4) and 9.17(a)(4).

  
Ken Hedges, Vice ~~President~~, Technology, AECL Technologies Inc.

Subscribed and sworn before me on this 28<sup>th</sup> day of November, 2003.

  
\_\_\_\_\_  
Notary Public

**Gregory Sayer**  
Barrister & Solicitor