

February 12, 2004

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

Attention: Ms. B. Sosa
Project Manager, ACR

References:

1. E-mail B. Sosa to V. Langman, "ACR-700 RAI Concerning PRA Quality", December 29, 2003.
2. Letter V. Langman to B. Sosa, "ACR Probabilistic Safety Assessment Methodology", July 31, 2003.

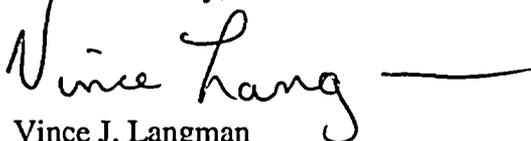
Dear Ms. Sosa,

Re: Response to NRC's Requests for Additional Information (RAIs) #3 on PRA Quality

Following an NRC's request (Reference 1) and in support of the NRC's pre-application review of the ACR (i.e., specifically focus topic # 11 – ACR PRA Methodology), attachment 1 provides AECL's responses to NRC staff requests for additional information on PRA quality. The NRC's questions and comments were generated from an initial review of Chapter 12, "Quality Assurance", of "Analysis Basis: Probabilistic Safety Assessment Methodology", AECL Report 108-03660-AB-001, Revision 1, July 2003, that was submitted to the NRC with Reference 2.

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

Yours sincerely,



Vince J. Langman
ACR Licensing Manager

/Attachments:

1. Response to NRC's Requests for Additional Information (RAIs) #3 on PRA Quality

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Attachment 1

(Letter V. Langman to B. Sosa, "Response to NRC's Requests for Additional Information (RAIs) #3 on PRA Quality", February 12, 2004)

Response to NRC's Requests for Additional Information (RAIs) #3 on PRA Quality

AECL's responses to NRC's requests for additional information on PRA Quality are provided in italic fonts following each of the NRC's questions as follows:

The following questions and comments were generated from an initial review of Chapter 12, "Quality Assurance," of "Analysis Basis: Probabilistic Safety Assessment Methodology," AECL Report 108-03660-AB-001, Revision 1, July 2003. This document is also being reviewed by the Office of Research (RES). Therefore, additional questions and comments may be generated at a future date.

33. Section 12, Page 12-1: Please discuss how the quality program described in the ACR Quality Assurance (QA) Manual is being implemented with respect to the PSA work. In particular, provide the QA audit schedule and discuss any findings made during previous QA audits.

AECL's Response:

The ACR quality assurance manual describes organisational structure of the ACR program and the duties of the Probabilistic Safety Assessment (PSA) and Safety Design Manager. This manager is responsible for completion of the ACR PRA. This document describes the AECL work processes, and procedures. One work process relates to PRA. Key elements applicable to the PRA work are as follows.

1. *Personnel performing the work are qualified, trained, and experienced (QA Manual Section 4.4). For each analyst, AECL has a personnel qualification and training form. Some staff have worked on PWR PRAs. The ACR PRA team has performed previous PRAs for CANDU nuclear power plants in Canada and overseas.*
2. *The analysis incorporates previous design, and operating experience (QA Manual Section 4.6). The ACR PRA incorporates previous CANDU PRA insights, design, and plant response experience in the identification of the initiating events (systematic review of plant design document), event tree analyses, and fault tree analyses. For example, the PRA will use CANDU and relevant LWR operating experience to derive the initiating event frequency. A Design Assist Role of PRA report is being prepared that summarizes insights from previous PRAs that are addressed in the ACR PRA.*
3. *Work planning and control (QA Manual Section 4.7) includes task identification, level of effort, resources, and schedule. The work progress is regularly monitored for progress. Work scope changes have to be authorized and controlled.*

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4. *Major analytical work (QA Manual Section 4.8) requires an Analysis Basis (AB) and an Analysis Report (AR). The AR document is equivalent to the PRA document. The AB document contains applicable inputs, assumptions, methods, and computer tools. The AR document contains the analysis results. The ACR PRA has documented the scope, methods and tools in the Probabilistic Safety Assessment Methodology, 108-03660-AB-001 Revision 1.*
 5. *Verification of the analysis (QA Manual Section 4.9) is planned and included in the work schedule. The verification comprises of supervisory review, and formal review comment and disposition. The latter includes typically one reviewer outside the ACR project. Technical Calculations are checked by a person not part of the ACR PRA team, but knowledgeable of CANDU PRAs.*
 6. *QA audits are planned for the safety engineering and licensing work that includes the PRA program.*

The schedule of the next ACR PRA QA audit is April 2004.

A QA audit of the ACR Safety Engineering (includes PRA) program was performed. Out of 75 items to be verified, non-compliance was found in 5 items, 4 of which were considered minor. Two deficiency findings were noted:

- *Preparation of job descriptions, personnel qualifications, and training forms, and in keeping training plans up to date.*
- *Documenting the checking conducted for technical calculations.*

There have been previous QA audits for the CANDU 6 plants constructed in South Korea and China. The main findings of those audits are the following:

- *The balance of plant design information was not available for system reliability analyses.*
- *All the analysts were not identified in the work schedule.*
- *Section heads are not familiar with the use of the Quality Control checklist.*
- *Confirmation of available operator action times needs to be documented.*
- *The labelling scheme coordinator needs to review the individual fault trees.*

For the Point Lepreau Refurbishment, an audit was performed by the CNSC of the process used to select design changes for the refurbishment project. CNSC reviewed the benefit cost analysis [BCA] process as well as the risk baseline that established a preliminary estimate of the core damage frequency. The assessment audit team stated that the processes used by AECL and New Brunswick Power were generally sound and were followed. The audit team noted that the training program was well organised. The audit team did not raise any observations as a result of this audit; they raised two recommendations:

- *Procedure clarity and flow, and*
- *Clear identification of the reason for rejecting a recommendation.*

34. Section 12.3, Page 12-2: This section lists the codes and standards that AECL will apply to the probabilistic safety assessment (PSA). However, Section 1.1, Page 1-2 identifies three additional references pertaining to quality of the PSA:

1. ASME RA-S-2002, "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications"
2. Standard Review Plan Chapter 19.1, "Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities"
3. Draft Regulatory Guide DG-1122, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities"

How will these three additional references be utilized to help ensure the quality of the ACR-700 PSA?

AECL's Response:

A review of items 1 & 2 was performed focussing on whether the ACR PRA scope, methods, and tools are consistent with these reports. The intent is for AECL to be aware of the USNRC requirements early in the licensing process. AECL has reviewed the above documents focussing on the design requirements related to the design stage PRA.

The main purpose of the ACR PRA is:

- a. to provide inputs to the design for optimization,*
- b. to reasonably ensure the safety of the plant design, and*
- c. to develop a base model for future use (RAP and risk informed regulation).*

The design stage PRA will have limitations in the quality for use in the risk-informed application due to lack of detailed design information and specific site and operational information.

Currently AECL does not have any specific risk-informed application items, but expects that future ACR owners will want to use the PRA for risk-informed application.

The ACR PRA will assess the adequacy of the design to meet the ALWR target of severe core damage and large release frequency. Accordingly the ACR PRA will satisfy as a minimum the Category 1 requirements of the ASME standard. AECL is reviewing the PRA standard (including the Addenda ASME RA-Sa-2003) and will apply the standard to the maximum extent possible for a design stage PRA. A table to show which ACR PRA attributes meet Category 2 requirements will be completed and provided as a response to the next set of RAIs on PRA, specifically to question # 37.

AECL is also reviewing USNRC Regulatory Guide 1.200 (draft previously issued as DG-1122) to see if any new requirements are documented.

35. Section 12.7, Pages 12-4 through 12-5: This section describes the review activities for the ACR-700 PSA work. Are there any plans for an independent, external (to AECL) peer review of the PSA before it is submitted to the NRC? If so, please describe in general the planned participants (e.g., Canadian Atomic Energy Control Board, other CANDU operators, IAEA), discuss their qualifications to perform the peer review, and describe the guidance/process/procedures they will use during the peer review. If not, please identify in general the AECL reviewers of the PSA, discuss their qualifications to perform the internal review, and explain how the internal AECL PSA reviewers maintain their independence from the AECL staff who are actually performing the PSA.

AECL Response:

AECL plans to have an external PRA peer review. The schedule of the peer review is not established yet. AECL is in the process of contacting external PRA organisations willing to perform the peer review. AECL will advise the USNRC of the peer review once the details have been finalised. In addition to the external PRA peer review, the internal AECL PRA review process is as follows:

1. *Supervisory review by the ACR PRA team leader;*
2. *Review by AECL staff outside the ACR PRA team:*
 - 2.1 *ACR designer: The ACR designers will review the models to ensure they reflect the latest design information. The designers, most knowledgeable of that specific ACR system, will review the event tree and fault tree modelling. The designers are graduate engineers or scientists, typically with at least 5 years of CANDU design experience. For external event PRA on seismic and fire, plant layout and modules staff will be requested to review the assumptions in terms of layout separation of components and electrical cable routing.*
 - 2.2 *PRA practitioners: The PRA practitioners are graduate engineers or scientists who typically have at least 5 years of PRA experience. This PRA experience includes fault tree, event tree analyses including plant response, and accident sequence quantification. The PRA staff have been trained via PRA courses and "on the job" experience. PRA reviewers may include members of the ACR PRA team. However, there is at least one PRA reviewer from outside the ACR project with relevant CANDU PRA experience (e.g., CANDU 6 plants). The reviewer performs the review in terms of whether the analyst followed the AECL QA manual and the PSA methodology document. One reviewer also repeats the calculations to ensure the results are consistent.*

36. Section 12.7.5, Page 12-5: During accident sequence quantification (ASQ), it is typical for many changes to be made to the PSA during the event tree and fault tree integration process (e.g., changes to resolve circular logic loops, logic flag settings, errors). As a result, previously reviewed and issued PSA documentation (e.g., system-level fault tree analyses) may be out of date with respect to the final integrated PSA model. Please describe how PSA documentation is updated to ensure that it is internally consistent throughout the project.

AECL Response:

The PRA model will specify the date of the latest design information at the time of model preparation. ASQ will be performed on these models. During ASQ, the PRA team will document the design changes, by reviewing plant drawings and design description to make a qualitative assessment on the final results. If the design changes are deemed significant, the models will be revised and ASQ redone in a subsequent PRA revision.

It is planned to revise the PRA during the construction and, operating license application stage, to reflect the "as built as operated" state at COL issue date. Further PRA updates during plant operation will be performed by the utility to reflect the "as operated state" of the plant during its lifetime.