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2005 October 12

SPOC-05-109
4161-00521-021-000

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Dear Ms. Levert:

**CNSC PUBLIC HEARING – 2005 OCTOBER 18 (SUPPLEMENTARY SUBMISSION)
AECL's APPLICATION TO EXTEND OPERATION OF
NRU FOR A PERIOD OF SEVEN MONTHS**

Further to AECL's formal application [1] and previous correspondence to the Secretariat [2 and 3] on the matter of the continued operation of the National Research Universal (NRU) Reactor, AECL is pleased to provide the enclosed document [4], as supplementary information for consideration at the public hearing, to be held at CNSC offices on 2005 October 18.

The oral presentation by AECL will commence with opening remarks from the President and Chief Executive Officer, Mr. R. Van Adel. This will be followed by an illustrated presentation from the Vice-President (Nuclear Laboratories), Dr. P.J. Fehrenbach, and the associated presentation material is enclosed for your consideration.

This supplementary material is provided in accordance with your letter [5].

I trust that you will find these enclosures satisfactory, but please call me should you have any questions or concerns.

Yours sincerely,

JEC/lsq
Attachment

J.E. Chilton
Site Licensing Manager

References

- [1] J.P. Létourneau, Letter to G. Lamarre, *Amendment of the Chalk River Laboratories Operating Licence - Removal of Clause 13.1 Pertaining to NRU Reactor Operation*, SPOC-05-038, 2005 April 15.
- [2] J.P. Létourneau, Letter to M. Leblanc, *Proposed Commission Hearing Dates for Consideration of AECL's Application for NRU Reactor Licensability Extension*, SPOC-05-055, 2005 June 10.
- [3] J.E. Chilton, Letter to L. Levert, *CNSC Public Hearing - 2005 October 18, AECL's Application to Extend Operation of NRU For a Period of Seven Months*, SPOC-05-081, 2005 August 18.
- [4] *Supplementary Submission for CNSC Public Hearing – AECL's Application to Extend the Operation of NRU for a Period of Seven Months*, NRU-00521-130-003, Revision 0, 2005 October.
- [5] L. Levert, Letter to J.P. Létourneau, *Notice of Public Hearing 2005-H-15*, 2005 June 30.

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CNSC Licensing

Supplementary Submission for
CNSC Public Hearing - AECL's
Application to Extend the Operation
of NRU for a Period of Seven
Months

Licensing-Single Point of Contact (SPOC)

**NRU-00521-130-003
Revision 0**

2005 October

Octobre 2005

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1. PURPOSE

This document is an update of the information provided in the 2005 August submission [1] in support of AECL's application to continue operation of the National Research Universal (NRU) Reactor beyond the shutdown date of 2005 December 31 identified in Licence Condition 13.1 of the Chalk River Laboratories Nuclear Research and Test Establishment Operating Licence and to modify the date in Licence Condition 13.1 to 2006 July 31.

The areas where additional information is provided in this document are:

1. Details of the scope of the NRU Licensability Extension (LE) Program (Section 2.1).
2. Progress on the NRU LE Program (Section 2.2).
3. Update on AECL Public Consultation Program (Section 2.3).
4. Progress on the NRU Improvement Initiative Program (Section 2.4).

2. UPDATED INFORMATION

2.1 NRU Licensability Extension Program

As previously presented in [1], AECL has implemented a comprehensive NRU LE Program to support continued operation of NRU beyond 2005 December. The objective of the NRU LE Program is to demonstrate that the reactor will continue to operate safely, reliably, and in compliance with regulatory requirements. In the absence of specific Canadian regulations for research reactors and specific regulatory guidance for NRU, AECL developed an approach based on Canadian and international regulatory principles. The overall approach adopted is risk informed, which is consistent with the Canadian regulatory framework and policy.

AECL adopted the International Atomic Energy Agency's (IAEA) Periodic Safety Review (PSR) process [2]¹, and IAEA requirements for research reactors [3]² as the basis for the PSR Gap Analysis described in [1]. The PSR Gap Analysis also compared NRU against CNSC requirements for a power reactor as far as practicable, even though these are not strictly applicable. The PSR Gap Analysis identified additional assessments and recommendations for improvements, which became the basis for the NRU Safety and Licensing plan. These activities represent a comprehensive safety review of NRU, which discussions with CNSC staff have indicated should satisfy the requirements for the full engineering and safety review recommended in a 2003 Commission Member Document [4]. Discussions continue with CNSC staff to address their comments and concerns with respect to the NRU Safety and Licensing Plan.

¹ Earlier draft version of reference was used.

² Earlier draft version of reference was used.

2.2 Progress on Safety and Licensing Plan

2.2.1 Safety and Licensing

As committed in the AECL Licence Amendment application [5], the *Periodic Safety Review Gap Disposition Report* and the *Final Report on the Phase 2a Plant Life Management Project for the NRU Reactor* were submitted to CNSC staff. In addition, the *NRU Tornado Assessment Report* was also submitted in 2005 October. To date, 17 of the 20 Safety and Licensing Action Items of the NRU Safety and Licensing Plan have been completed and documentation has been submitted to CNSC staff. The action items that are still outstanding are:

- Plant Life Management (PLiM) Program actions,
- Severe Accident Management Guide for NRU,
- and the update of the NRU Safety Analysis Report. The NRU Safety Analysis Report update has been postponed to 2006 March as requested by CNSC staff.

Table 1: Summary Status of NRU LE Safety and Licensing Action Items

NRU LE Action Item	Description	Task Status
1	Revise Section 3.5 of the Safety Analysis Report to include the Codes and Standards applicable to each system in NRU.	Completed
2	Review the NRU Change Control Records and assess the impact of these changes on the findings documented in the Safety Analysis Report. Any identified impact will be addressed as part of the scope of the Safety Analysis Report Revision.	Completed
3	The PLiM Program is designed to deal with issues on in-service inspection, condition assessment, refurbishment and/or replacement of components. Details to address these findings can be found in the PLiM Program Plan. An Interim report incorporating the progress on these issues was tabled in 2005 April.	Final Report on Phase 2a Completed; Assessment report Status reported in Section 2.2.2.
4	Prepare Assessment Report to evaluate the elements in the IAEA requirements on human factors and compare that to the human factors efforts in NRU. Incorporate the information into a section in the revised Safety Analysis Report.	Completed
5	Summarize the impact of NRU operations on non-human biota in the revised Safety Analysis Report.	Completed
6	Prepare Beyond Design Basis Accident Assessment Report for NRU. (This has been renamed as Severe Accident Assessment Report.)	Completed
7	Prepare Severe Accident Management Guideline for NRU.	Scheduled for 2006 March
8	An Assessment Report on local conditions following a postulated Loss-of-Coolant Accident will be prepared to evaluate the impact of these conditions on the safety functions of equipment and components.	Completed

Table 1: Summary Status of NRU LE Safety and Licensing Action Items

NRU LE Action Item	Description	Task Status
9	The analysis of the in-core Loss-of-Coolant Accident has been documented, will be reviewed and incorporated into the revised Safety Analysis Report.	Completed
10	An integrated Report will be prepared to combine the individual probabilistic analyses for NRU into a more conventional Probabilistic Safety Analysis report format and develop event sequences with frequencies less than the 10^{-6} /a. This can be used to establish the frequency of severe core damage states and input into the Post Design Basis Accident Management Guidelines.	Completed
11	An Assessment Report on the potential impact of jet forces/pipe whip resulting from a loop Loss-of-Coolant Accident will be prepared to address this recommendation.	Completed
12	Incorporate in the revised Safety Analysis Report the rationale and justifications for the Vented-Confinement system, the Single Shutdown System with two independent Trip trains and Design Basis for the New Emergency Core Cooling.	Completed
13	The scope of Section 17 in the Safety Analysis Report will be expanded to include the Limiting Conditions of Operation (LCOs) for the new NRU Safety Upgrades - as part of the Safety Analysis Report Revision.	Completed
14	The revised Safety Analysis Report will include expanded discussions on analysis methods, computer code validation and quality assurance.	Completed
15	There is no formal definition of a guaranteed shutdown state for NRU. A section will be added to the revised Safety Analysis Report describing the various Shutdown States in NRU.	Completed
16	A Fire Hazard Assessment Report has been committed to the CNSC as part of the Reactor Safety Evaluation Project actions. Results from these reports will be incorporated in the revised Safety Analysis Report.	Completed
17	A Tornado Assessment Report has been committed to the CNSC as of the Reactor Safety Evaluation Project actions. Results from this report will be incorporated into the revised Safety Analysis Report.	Completed
18	Section 3.4.1 (Safety Culture) of the Safety Analysis Report will be expanded to include additional details on the application of safety culture in NRU relative to IAEA guidelines.	Completed
19	Section 16.13.6.4 (Operations in Adjacent Buildings) of the Safety Analysis Report will be expanded to include the assessment of the potential impact on NRU of the MAPLE 1 and 2 reactors and the New Processing Facility.	Completed
20	Issue Revision 1 of the NRU Safety Analysis Report.	Re-scheduled for 2006 March in agreement with CNSC.

The NRU LE Safety and Licensing Plan was developed using the Periodic Safety Review process. It is worth noting that the PSR process does not require compliance with all current safety standards, only a comparison with them to identify any shortfalls that may exist, and a disposition of such shortfalls. If it is reasonable and practicable to make design changes to eliminate the shortfalls, then these should be done. If it is not practicable to make design changes, then an overall assessment of the risk posed by operating the plant should be carried out. For NRU, this involved the completion of a Level 3 Probabilistic Safety Analysis (PSA) and a Severe Accident Assessment. Together these demonstrate that the overall risk to the public posed by operating NRU is acceptably low.

The Severe Accident Assessment report documents deterministic and probabilistic assessments of severe accidents initiated by rare combinations of internal failures in the upgraded NRU. This type of information has not been available previously for the NRU Reactor and completion of this assessment represents a major step forward in understanding the safety of NRU.

The Severe Accident Assessment confirms that the continued operation of the NRU Reactor, does not present the public with risks that are significant in comparison with the risks to which the public is normally exposed. This assessment augments existing safety assessments for NRU and covers accident frequencies lower than those discussed in the NRU Safety Analysis Report.

2.2.2 Plant Life Management

Inspections have been carried out to support the conclusions and recommendations of the Aging Assessments (i.e., Life and Condition Assessments) for the PLiM Program. The majority of the inspections focused on the main heavy water system pressure boundary. These completed inspections are listed in Table 2 below, and the results and conclusions are documented in the individual Life Assessment (LA) and Condition Assessment (CA) reports, many of which have already been submitted to CNSC staff. These include the Heavy Water System CA, Reactor Vessel LA, Heavy Water Heat Exchanger LA, and the Heavy Water Pump LA. In addition to the aging assessments, a Periodic Inspection Program has been developed for the heavy water system pressure boundary. Inspections have been performed in accordance with this Periodic Inspection Program to meet the committed schedule and to support conclusions of the aging assessments. As defined in the Periodic Inspection Program, a report of the inspection results will be submitted annually to CNSC staff.

A sufficient number of representative inspections have been completed to support the PLiM Program conclusion that the heavy water system is in good condition. The outstanding heavy water system inspections will be completed next year. Inspections performed on other less critical systems and components, such as thermal shield and non-heavy water system piping, are discussed in their respective condition assessment reports. They are also listed in Table 2.

In addition to the inspections, an important part of the assessment process is a system walkdown. This is a detailed inspection assessment by system experts to evaluate equipment condition and operating performance. Walkdowns have been completed for over 30 condition and life assessments and on the gap analysis reports (e.g., Tornado and Pipe Whip).

Table 2: Summary of PLiM Inspections of NRU Components as of 2005 September

No.	Description	Status
1	Main Heavy Water Pumps	Completed 2004 November - Visual and liquid penetrant inspections of the pump casing and internal parts.
2	Thermal Shields Inspections	Completed 2004 November - Wall thickness measurements on L-131 and L-1048.
3	Vessel Inspection	Completed 2005 January 11 - Wall thickness measurements. Report issued 2005 April 04.
4	Water Reflector Inspection	Completed 2005 January - Ultrasonic and 2005 April visual inspections.
5	Firewater Piping Inspection	Completed 2005 January, 2005 February and 2005 March - Radiographed sections of firewater piping.
6	Heat Exchanger 7 Shell Inspections	Completed 2005 February. Visual: Bolts of the upper, middle and lower shell flanges, and shell supports. Liquid Penetrant: upper and lower heads.
7	Bellows Inspections	Completed 2005 February - Eddy current, wall thickness, ultrasonic, and liquid penetrant inspections of lower bellows Heat Exchanger 7.
8	Main Heavy Water Piping Supports	Completed 2005 February - Visual inspection of supports and spring settings on Grinnell hangers for Circuits 2, 3, 6, and 7.
9	Heat Exchanger Shell Supports	Completed 2005 February – Visual inspection of shell supports.
10	Main Heavy Water Piping Inspections	Completed 2005 April - Ultrasonic inspection on Heat Exchanger 7 Weld 4.
11	Periodic Inspection Program General Inspections	Completed 2005 May: Ultrasonic inspection of two welds on Line 82 in Room 105. Liquid penetrant inspection of indications on V-5004. Liquid penetrant and visual inspections of V-6341 and V-6175. Visual and liquid penetrant inspection of pipe supports on Lines 46 and 82.
12	Reactor Concrete Structure Inspections	Completed 2005 July - Visual inspections.
13	Cable Inspections	Completed 2005 August - Visual inspection of cables in highly ranked systems and accessible locations.
14	Heat Exchanger 5 Elbow Support Structure Welds	Completed 2005 September – Liquid Penetrant on the inlet elbow structure welds on Lines 60 and 61 of Heat Exchanger 5.
15	Chimney Inspection	Completed 2005 September - Visual and Non Destructive Examination (NDE) inspection of the NRU stack, Building 158.

An important criterion for continued operation of the NRU Reactor, and hence a key focus of this document, is its material condition. NRU's PLiM Program assessment and inspection results to date, confirm that the reactor's critical systems, structures, and components support continued operation safely and reliably.

2.2.3 Aging Management Program

The Aging Management Program was described in Reference [1].

AECL is implementing a "living" Aging Management Program. This is a formal and structured program, which will provide assurance that the facility systems, structures, and components function as designed to provide safe and reliable operation of the plant. This is done through systems, controls and practices to detect and mitigate in a timely fashion aging related degradation mechanisms in the systems, structures, and components.

An update on progress on this program is provided below: the Aging Management Program framework documents have been reviewed and are being revised for acceptance by AECL management. While the Aging Management Program Plan is being finalized, several enabling actions are being taken to implement the Aging Management Program.

These include:

1. A review of maintenance practices, particularly the way in which actions are taken and inspection results recorded, and the way relevant information for asset management is being brought forward.
2. The Action Items Registry database has been established. The database has been populated with all recommendations arising from the aging assessments on the most important (Phase 2A) plant critical systems, structures, and components. Its various functions (review, report query) have been tested.
3. An initial review to consolidate, classify (priority) and categorize (risk level) the Action Items Registry records is in progress.
4. A Management Committee to disposition recommendations has been established.

The Action Items Registry database continues to be populated with the recommendations from the NRU Safety and Licensing Action Items and the Phase 2B aging assessments, as these are completed.

2.3 Update on AECL Public Consultation Program

As a follow up to the community meetings held in 2005 May, AECL offered a tour of the NRU Reactor to interested community members. Two evening tours resulted: on 2005 August 10, four Deep River residents visited the reactor and on 2005 August 11, three residents of Deep River and two residents of Chapeau (Québec) visited. No concerns were raised about the safety of the operations and no subsequent requests for information were received. The four participants who visited on 2005 August 10, subsequently submitted an intervenor package in support of AECL's application to continue the operation of the NRU Reactor. Their request to give an oral presentation was accepted by the Commission and

the resulting Commission Member Documents have been added to the agenda for 2005 October 18.

In addition, on 2005 August 08, AECL staff met with the interested citizen in Chichester (Québec) following his intervention to the CNSC on 2005 June 29. He was concerned about the lack of air monitors on the Québec side of the Ottawa River. During the meeting, AECL staff provided information on our environmental monitoring programs, supplied information on cancer statistics for Pontiac County as provided to AECL from the Pontiac Health Unit and then took him on a tour of five monitoring locations. AECL has since installed additional tritium and carbon-14 monitors at Demers Centre. A press release is being prepared to inform the public of this development.

2.4 NRU Improvement Initiative

Initial progress on the NRU Improvement Initiative was described in AECL's submission [1]. Since that time, the improvement plan has been further developed in parallel with progress being made on the short-term activities.

An independent review of the plan by external experts was completed. The reviewers originally involved in the initial industry peer review that, in part, forms the basis of the plan. The review confirmed that the plan is on target, and made some suggestions for improvement. Its primary suggestion was to include a mechanism that verifies completeness and effectiveness of the individual activities. This suggestion will be incorporated.

The plan was then presented to and endorsed by AECL's Executive Management Committee. In so doing, the Executive Management Committee assured its ongoing support for this initiative.

An NRU Improvement Initiative Project Director has been assigned on a full time basis to ensure there is appropriate effort and focus on execution of the initiative. The project director reports to the NRU Facility Authority, who is the owner of the improvement plan, and obtains guidance from external industry experts who have managed similar improvement programs at power reactor facilities.

The following is an update on progress on specific activities within the NRU Improvement Initiative.

1. Raising staff awareness and providing a sense of urgency for change:
 - The Vice-President of the Nuclear Laboratories met with the representatives of the site unions to explain the Improvement Initiative, seek their support, and obtain feedback on the views of union membership regarding this initiative.
 - NRU managers presented the Improvement Initiative Plan to their staff and discuss progress on a regular basis.
2. Improve plant condition by raising standards of housekeeping:
 - A detailed housekeeping improvement plan has been developed and staffed.
 - One completed room is being used as a standard to demonstrate the expectations of management. Loose combustible material was removed, spare parts stored in the room were removed, catalogued and stored in a retrievable manner, and the floor and walls were painted.

- Progress has been made in many other areas of the facility. Wood shelves and racks have been removed and replaced with metal structures. Special storage areas and storage equipment have been set up, and spare parts removed, catalogued and stored appropriately.
- A new storage building is being designed and will be constructed next to NRU. Having a dedicated storage facility will support maintaining the new housekeeping standard by avoiding the need to use the reactor building for routine storage.
- Processes have been developed and implemented to prevent, as much as practical, combustible materials from coming into the NRU Reactor building. For example, equipment being shipped to NRU is unpacked before it enters Controlled Area 2, such that combustible packing material is kept outside Controlled Area 2.

3. Implement event free tools:

The “event free tools”, a nuclear utility practice to reduce errors, will be introduced to NRU staff in conjunction with a Chalk River Laboratories Human Performance improvement initiative. Procedures have been obtained from Ontario Power Generation related to the implementation of “event free tools”, and will be used as the basis for NRU specific procedures. “Three-way communications” is in the process of being introduced into the facility. Other “event free tools” will be introduced over the course of the coming months.

4. Provide more day-to-day management safety oversight:

Operational decision-making in response to off-normal plant conditions requires clear management guidance to shift staff and to senior managers. Industry standard techniques for dealing with such situations will be implemented. Progress to date includes:

- A new reactor restart policy has been issued. This policy requires that a more comprehensive checklist of items be completed prior to restart, to ensure that the cause of an unplanned trip is completely understood and that appropriate corrective actions have been taken. This policy is similar to those implemented at power reactors, and is intended to relieve the operators of any perceived pressure to restart after an unplanned trip.
- An Operational Decision Making process has been implemented. This process, again similar to what is done at power reactors, brings together NRU managers and any necessary external managers, to deal expeditiously with off-normal situations that call for prompt decisions. Decisions are recorded and subsequently assessed to learn from experience. This process relieves the NRU Operations Manager from having to make complex decisions that could impact safety.

5. Improve management effectiveness:

- The NRU Management Team held a workshop to review the management structure and to recommend changes that would permanently address issues that have challenged management's ability to be as effective as desired. The NRU Management Team developed a new structure that will result in additional managers on the team.
- An experienced Chalk River Laboratories manager has been appointed, on a temporary basis, to develop and oversee the staffing of the new management structure on behalf of the NRU Facility Authority. This will allow the NRU Facility Authority, and the existing managers, to focus on safe operation while the new management structure is being developed and staffed.

6. Provide adequate resources:

- Eight external consultants with power reactor experience in similar improvement initiatives are now working at NRU to assist with this effort.
- Permanent resources continue to be added to NRU. Seventeen of 22 vacancies have been filled since 2005 June, and AECL is actively pursuing the remainder.
- Former NRU operating staff have been re-assigned temporarily to NRU to support operation while the improvements are being implemented.
- A workshop to come up with a redesigned NRU management structure was held and a new organization defined. An experienced Chalk River Laboratories manager has been assigned temporarily to work with the NRU Facility Authority to further develop the roles and responsibilities for this new organization.
- The resource study requested by CNSC staff is underway and making good progress. AECL and CNSC staff have been communicating regularly to ensure that CNSC staff is apprised of the status and results of the study.

3. SUMMARY AND CONCLUSION

In conclusion, AECL is requesting the Commission approval to change the date in Licence Condition 13.1 of the Chalk River Laboratories Nuclear Research and Test Establishment Operating Licence to 2006 July 31. We are seeking this change as an interim measure to allow time for:

- completion of the outstanding work required to support continued operation of NRU beyond 2006 July;
- CNSC staff to complete its review all AECL submissions;
- AECL to respond to CNSC comments and requests for further information; and
- CNSC staff to formulate their recommendations to the Commission on AECL's application to remove Licence Condition 13.1.

In AECL's view, the information submitted to date supports continued operation of NRU to at least 2006 July 31.

4. REFERENCES

- [1] J.E. Chilton, Letter and Attachments to L. Levert, *CNSC Public Hearing-2005 October 18, AECL's Application to Extend Operations of NRU for a Period of Seven Months*, SPOC-05-081 / 4161-00521-021-000, 2005 August 18.
- [2] IAEA, *Periodic Safety Review of Nuclear Power Plants Safety Guide*, Safety Standards Series No. NS-G-2.10, 2003 September.
- [3] IAEA, *Safety of Research Reactors*, Safety Requirements No. NS-R-4, 2005.
- [4] CNSC, *Atomic Energy of Canada Limited, Renewal of the Chalk River Laboratories Nuclear Research and test Establishment Operating Licence, Public Hearing Day 2, April 9, 2003*, Commission Member Document, CMD 03-H2.
- [5] J.P. Létourneau, Letter and Attachments to G. Lamarre, *Amendment of the Chalk River Laboratories Operating Licence – Removal of Clause 13.1 Pertaining to NRU Reactor Operation*, SPOC-05-038 / 4161-00521-021-000, 2005 April 15.