

AECL-CNSC PROTOCOL FOR THE RESTART OF THE NRU REACTOR

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Revision 1



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire

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Summary of Changes

Section	Change
Part II, Section 5 Readiness for Service, last bullet	An additional bullet where AECL is now requested to provide an update on the ongoing investigation into fuel failures, demonstrating that the fuel being reloaded into NRU is not likely to fail.
Part II, Section 6, Fuel Hold- Point	This new section allows AECL to partially reload fuel into the NRU core up to an agreed, temporary guaranteed subcritical condition, before approval to restart is requested from the Commission. This request to restart will be made at a Commission hearing (tentatively mid-February), and the change in hold point will ensure the vessel is filled with heavy water and tested for leaks by the time of the hearing. Only once approval to restart is granted will AECL be allowed to load additional fuel into the core.
Appendix B, Weld Repair and Post Repair NDE Activities	Added to describe the documents, records and approval levels required related to weld repairs, post repairs and NDE activities, including timeline and status.
Appendix C, Deliverables Contained in the NRU Restart Protocol	Added to provide a timeline for the submission of the information and deliverables requiring review by CNSC staff under the Protocol.

PROTOCOL FOR THE NRU RESTART LICENSING ACTIVITIES

PREAMBLE

In May 2009, a small leak was discovered in the vessel of the NRU reactor at Atomic Energy of Canada Limited's (AECL) Chalk River Laboratories. The reactor was placed in a safe shutdown condition and AECL subsequently decided to de-fuel the reactor to complete inspection and repair activities. While most aspects of such a repair are covered by conditions in the Chalk River Laboratories site licence, there are some unique considerations to the repair and restart of the reactor. Given these considerations, the Canadian Nuclear Safety Commission (CNSC) has determined that Commission approval will be required to re-fuel the reactor beyond a defined temporary guaranteed sub-critical condition approved by CNSC staff. AECL and the CNSC have decided to formally document the requirements to support such a request to re-fuel the reactor.

PURPOSE

The purpose of this Protocol for the NRU Restart licensing activities is to establish the administrative framework, milestones and service standards for the licensing activities in relation to the restart of the NRU reactor after repair of the reactor vessel, including the submission by AECL of the technical information to support an application for Commission approval to re-load fuel in the reactor and the CNSC review of this technical information.

This Protocol covers the following phases of the work to return the NRU reactor to service:

- Assessing the condition of the NRU reactor vessel
- Repairing the reactor vessel (including the post-repair inspection)
- Re-establishing the reactor's fitness for service (including mitigation of the degradation mechanism)

These milestones have been established on the basis of a number of assumptions, some of which relate to activities of participants to this project that are not signatories to this Protocol. Should events unfold in a manner that is different from what has been assumed in this Protocol, the milestones will have to be revised, following the processes outlined in this Protocol.

Nothing in this Protocol fetters the powers of Designated Officers, Inspectors or the Commission respecting regulatory decisions or taking regulatory action for the purposes of the *Nuclear Safety and Control Act* (NSCA), transparently and independent of any undue influence.

Nothing in this Protocol is to be construed or interpreted as affecting the jurisdiction and discretion of the CNSC in any assessment of any application for licensing purposes under the NSCA.

The remainder of this protocol is divided into two parts:

- Part I defines the framework (roles, communication lines and reporting requirements)
- Part II sets out the information requirements to support an application for the return to service of the NRU reactor

PART I - FRAMEWORK

1. PARTIES

The parties to the Protocol have the following roles and responsibilities:

- The CNSC has regulatory and statutory responsibilities under the NSCA and its regulations and is responsible for assessing the request for AECL to allow the NRU to be re-fuelled.
- AECL is a Crown corporation, owned by the Government of Canada and is the licensee for the Chalk River Laboratories site and the operator of the NRU reactor, with all statutory and other responsibilities as licensee and operator.

Managers

For this Protocol, the Managers representing each party are as follows:

- The Director of the CNSC's Chalk River Laboratories Compliance and Licensing Division (Miguel Santini)
- AECL's Director of Regulatory Affairs and Safety Analysis (Bernard Gerestein)

Each party will identify alternates in the event that the primary Manager is unavailable.

Executive Management Committee

The parties to the Protocol agree to form an Executive Management Committee comprised of senior management representatives from the parties to the Protocol. The Executive Management Committee will receive and review progress reports and will also serve to resolve issues.

The members of the Executive Management Committee are set out as follows:

- The Executive Vice-President of the CNSC's Regulatory Operations Branch and Chief Regulatory Operations Officer (Ramzi Jammal)
- The Director General of the CNSC's Directorate of Nuclear Cycle and Facilities Regulation (Peter Elder)
- AECL's Senior Vice President and Chief Nuclear Officer (Bill Pilkington)
- AECL's Chief Regulatory Officer (Andrew White).

Each party will identify alternates in the event that the primary committee member is unavailable.

2. DURATION

This Protocol will come into effect upon the date of the signing of the Protocol by both parties to the Protocol. This Protocol will terminate on the date that the Commission Secretariat announces the Notice of Hearing in respect of the application to re-fuel the NRU reactor.

3. COMMUNICATION/TIMING

As stated above, the CNSC has determined that Commission approval will be required before any fuel is added to the NRU reactor beyond the fuel loaded as authorized by a pre-defined temporary guaranteed sub-critical condition approved by CNSC staff. Therefore AECL will need to present a safety case for restarting the reactor to the CNSC in order for CNSC staff to make a recommendation to the Commission and for the Commission to make a decision.

In order to minimize the time between the submission of this safety case and the submission to the Commission of CNSC staff's Commission Member Document (CMD), issues will need to be resolved before AECL submits its request for reloading fuel in NRU. Consequently, AECL will need to be proactive in submitting information to the CNSC, and submit this as early as possible, so that there is adequate time for review by CNSC staff and satisfactory resolution of issues. In addition to this exchange of submission and response correspondence, the parties will meet, as necessary, to clarify intentions and facilitate common understandings, with the aim of achieving the target timelines.

Within three working days of receiving from AECL technical information submitted under this protocol, CNSC staff will first perform a cursory review (for conformity with the information requirements) to identify any obvious deficiencies and communicate any such problems to AECL. Within fifteen working days of its reception, CNSC staff will have completed the review of the submission and provided to AECL its assessment.

Provided that AECL has been proactive in submitting the information outlined in this Protocol so that, by the time it submits its application to re-fuel the NRU reactor,

- CNSC staff has had fifteen working days for performing its review, and
- all technical issues have been resolved.

CNSC staff will prepare and submit its CMD to the CNSC Secretariat within 10 working days of receiving AECL's application.

The issuance of correspondence will follow the *Communications Protocol for CNSC Staff and AECL-CRL Licensee* current at that time.

4. ISSUE RESOLUTION

The parties to this Protocol will use their best efforts to resolve any differences of opinion in the interpretation or application of this Protocol in an effective and timely manner.

The following review and dispute resolution mechanism will be used during the review to assist timely completion.

Step 1: Issue identification

It is the intention of both parties to resolve issues relating to the submission of the technical information and the regulatory review through direct discussions and collaboration between the Managers.

Monthly AECL/CNSC review meetings will be held to review progress and highlight any potential major issues or disputes. Additional meetings may be called for urgent matters as required.

If an issue cannot be resolved at this level, it will be documented (typically, a brief factual summary of the issue and a paragraph representing the view of each organization) by the Managers and forwarded to the members of the Executive Management Committee within three working days of failure to resolve.

Step 2: Executive Management Committee

Where an issue cannot be resolved through the Managers, the Executive Management Committee agrees to meet within three working days of notification of the dispute with the intention of expeditiously resolving the impasse. Issue resolution is to be documented.

If an issue cannot be resolved at this level, it will be referred to the signatories of this protocol within three working days of the meeting of the Executive Management Committee, supported by the original or revised documentation from step 1.

Step 3: Presidential level

An unresolved step 2 issue will be referred, with documentation, to the signatories of this protocol for resolution. A meeting will be called, normally within five working days, to resolve the issue and document its resolution.

5. REPORTING

The Managers will jointly produce a one-page dashboard-style report on a monthly basis demonstrating progress, status of activities and items of concern / risk to completion. The report shall be submitted to the Executive Management Committee within three working days of the end of each calendar month that this Protocol remains in effect.

6. EXTERNAL COMMUNICATIONS

Throughout the duration of this Protocol, all parties agree that communications will be open and transparent and that information destined for public release will be coordinated through the designated Managers (or alternates, where designated) with support from each party's communications division. Further, these communications will be done in coordination with, and in consideration of, each party's communications protocols.

7. FUTURE REVISIONS OF THE PROTOCOL

Revisions of this Protocol will be coordinated by the Managers and must be approved in writing by the signatories of the Protocol.

PART II – REQUIREMENTS FOR NRU RESTART

The information to be submitted by AECL to CNSC staff before CNSC staff can prepare a recommendation to the Commission for re-fuelling the NRU reactor will need to address the following areas:

1. ASSESSMENT

A comprehensive Condition Assessment of the NRU reactor vessel is required to evaluate the state of the vessel, the extent of the corrosion damage, the general fitness for service and the proposed repair option. To achieve the high level of confidence required of the assessment of the reactor vessel, CNSC staff needs this assessment to include:

- a comprehensive visual inspection of the outside of the vessel;
- thickness measurements for 100% of the vessel's circumference at the elevation of the leak and for any other areas of concern identified during the visual inspection;
- a root cause analysis identifying the degradation mechanism; and
- a root cause analysis identifying human and organizational factors that led to the current situation.

2. REPAIR

As already noted in the preamble, many aspects of the repairs to the NRU vessel are covered by existing conditions in the Chalk River Laboratories site licence and these conditions remain in force for the current repairs. This includes:

- before proceeding with the repair of the reactor vessel, request and obtain CNSC approval of the code classification for this vessel in order to determine the applicable requirements for the repairs;
- satisfy the applicable requirements of the ASME Codes (referred to as code repair) for the repair method for the vessel or, if that is not possible, develop a non-code repair solution, in which case AECL is required to request and obtain CNSC approval for the repair as per CSA standard N285.0. CNSC staff will evaluate the proposed repair method based on the acceptance criteria described in the Appendix A;

- if required, AECL will revise the NRU vessel Over-Pressure Protection Report and have this report accepted by CNSC staff before AECL's application to reload fuel in NRU;
- prepare a repair plan in accordance with the N285 series of standards, to describe the repair process and the steps taken to ensure that the repair process meets the applicable codes and standards;
- where required, obtain TSSA acceptance; and
- if required, obtain dispositions (including for any areas of the vessel that are non-conforming and are not repaired) and code case approvals from the CNSC.

As part of the information to be submitted by AECL before CNSC staff can prepare a recommendation to the Commission, AECL will in addition need to provide to the CNSC:

- its repair plan (just described above);
- proof that it has followed established codes, standards and processes for the repairs, as prescribed by the Chalk River Laboratories site licence (including the responsibilities of the Owner and of the repair organization, requirements for the Repair / Replacement program and plan, quality assurance, non-destructive examination, records and reports, etc.); and
- proof that it has received TSSA acceptance, where required.

3. POST-REPAIR INSPECTION

Concerning the post-repair inspection, AECL will need to:

- provide to the CNSC the results of the inspection of the repairs to the NRU reactor vessel to confirm its fitness for service; and
- submit, for acceptance by CNSC staff, a Periodic Inspection Program (PIP) that covers the NRU reactor vessel and give evidence of its implementation.

4. MITIGATION OF DEGRADATION

In the area of degradation mitigation, AECL will need to document and provide to the CNSC:

- the mitigation measures to address the degradation mechanism that caused the failure of the vessel; and
- evidence that these mitigation measures are appropriate and effective (this includes addressing the effect of the reflector leaks and the presence of air in the J-rod annulus).

5. READINESS FOR SERVICE

Once all repairs and inspections are completed, AECL will need to provide to the CNSC a detailed fitness for service assessment of the NRU reactor that:

- includes the repair report prepared according to CSA standard N285.0 in order to demonstrate that the pressure boundary of the reactor vessel has been re-established and that the vessel is fit for continued service for a defined period of time;
- confirms compliance of NRU with its Safety Analysis report;
- identifies and addresses the gaps of the Condition Assessment prepared for the 2005 NRU licence extension;
- shows that the organizational and human factors involved in the current vessel leak are being addressed by a Corrective Action Plan which includes effectiveness verification measures; and
- provides an update on the ongoing investigation into fuel failures that occurred prior to NRU shutting down with the objective of demonstrating that the fuel being loaded into NRU is not likely to fail.

6. FUEL HOLD-POINT

Once the repairs to the vessel are completed, AECL may partially reload fuel into the NRU reactor up to a predetermined Fuel Hold-Point, which shall be defined and supported by a temporary guaranteed sub-critical condition acceptable to CNSC staff. Refuelling of the NRU reactor beyond this Fuel Hold-Point is conditional to Commission approval for the restart of the NRU reactor.

7. OTHER OUTAGE WORK

The extended shutdown of NRU is a unique opportunity to perform maintenance and other activities on the reactor and its systems that are normally limited by time constraints, excessive radiation fields and other obstacles, in addition to other work identified as part of the *Protocol for National Research Universal Licensing Activities* signed by both AECL and CNSC Presidents on July 15, 2008.

CNSC staff will need from AECL the description of such activities performed during this outage, as well as adequate justification for the deferral of those activities that will require defueling the reactor or an extended shutdown at a later date.

8. DETAILS ADDED AS PROJECT PROGRESSES

For clarity, and as details related to this project become developed and agreed upon, the 2 organizations agreed to document them in this section and make them part of the Protocol.

- Appendix B: documents the activities related to the Weld Repair and Post Repair Non-destructive Examinations. These activities are aligned with the requirements in CSA 285.0. The purpose of the table is mainly to list the main activities related to the weld repair and it shows target dates only as an indication of schedule; these target dates may need to be adjusted on the run as the project advances.
- Appendix C: is an AECL submission which documents all the documents AECL is preparing to submit in support of the reactor return to service. The letter also maps out the contents of these submissions with the deliverables listed in this protocol

PART III - AGREEMENT

The parties hereto have signed the Protocol, in counterpart, on the dates indicated below.



Hugh MacDiarmid
President and Chief Executive Officer
ATOMIC ENERGY OF CANADA LIMITED

Date: Jan 16/10



Michael Binder
President and Chief Executive Officer
CANADIAN NUCLEAR SAFETY COMMISSION

Date: JAN 07 2010

APPENDIX A

Non-Code Repair

When the required code repair becomes impractical, AECL may request CNSC to grant relief for a non-code repair as per CSA standard N285.0. Such a non-code repair is not permitted without prior relief from the CNSC. In addition, this non-code repair will remain an ASME Code controlled activity subjected to regulatory audit.

As part of the activities for a non-code repair:

1. The licensee is required to submit the appropriate calculations and analyses for modifications to the pressure boundary performed as part of the non-code repair process. Examples include drilling holes into the vessel wall and calculating the loads on bolts that result from sealant injection.
2. Repair procedures require an operability assessment that addresses issues such as the quantity of leak sealant to be injected for mechanical clamping, the impact of the entry of any excess sealant into the system, consequence analysis for downstream plugging, and possible chemical contamination of the system.
3. The licensee is to consider the environment effect on the sealants and fasteners for mechanical clamping readiness.

AECL will also need to specify the period of validity for this non-code repair, after which it will be removed and replaced with a permanent Code Repair or by a new vessel.

As a non-code repair is an activity that may affect the pressure boundary, it requires suitable evaluation and controls. For this, the licensee may follow the evaluation approaches documented in USNRC General Letter 90-05 which provides two specific flaw evaluation approaches, namely, the "through-wall flaw" and the "wall thinning" approaches.

Acceptable standards/guidelines for a non-code repair to the NRU vessel that will be considered by CNSC staff include, but are not limited to:

1. USNRC, NUREG/CR-6615. A Survey of Repair Practices for Nuclear Power Plant Containment Metallic Pressure Boundaries, 1998.
2. USNRC, Generic Letter 90-05, Guidance for performing temporary non-code repair of ASME code class 1, 2, and 3 piping, 1990.
3. ASME B&PV Code Section XI Mandatory Appendix IX, "Mechanical Clamping Devices for Class 2 and 3 Piping Pressure Boundary", 2007 Ed, 2008 Ad.

The CNSC may relax some of requirements from the above standards and guidelines. The CNSC may accept recognized industrial and international standards and best practices for a non-code repair.

APPENDIX B

NRU VESSEL LEAK REPAIR PROJECT WELD REPAIR AND POST REPAIR NDE ACTIVITIES

Milestone/Deliverable	Target Date
Repair Plan	
<i>Including repair description and confirmation of QA controlled under AECL (CFS) Certificate of Authorization</i>	
Draft Repair Plan submitted to CNSC and TSSA	Completed
Final Repair Plan submitted to CNSC and TSSA	Completed
Welding Procedure Specification (WPS), Procedure Qualification Record (PQR)	
AECL / TSSA preliminary meeting	Completed
Draft PQR / WPS submitted to TSSA	Completed
AECL / TSSA review meeting in Hamilton (Liburdi)	Completed
Procedure Qualification (PQR) in Hamilton (Liburdi)	Completed
Final WPS / PQR submitted to TSSA	Completed
TSSA registration of PQR	Completed
Welder Performance Qualification (WPQ) in Hamilton (Liburdi), witnessed by TSSA	Completed for vertical welding tool To be completed prior to the use of horizontal tool but may be after start of vertical welding
Repair method test procedure submitted for information to TSSA and CNSC	
Repair method test in Hamilton, witnessed by TSSA and CNSC <i>Proving whole configuration of weld set up</i>	
Post-weld NDE	
Final (remote) NDE procedures submitted to TSSA	To be completed pre-repair except that those inspections that are post-repair only, may be submitted to TSSA and demonstrated after the repair has started,
NDE procedures demonstrated at CRL, witnessed by TSSA <i>Demonstration of visual inspection procedure may occur as part of PQR demonstration in Hamilton (Liburdi)</i>	
TSSA acceptance of NDE procedures	
NDE Operators performance demonstration at CRL, witnessed by CNSC and TSSA (lead)	
<i>If needed, TSSA / CNSC may be involved in project rehearsals</i>	
Pre-Service Leak Test of Vessel	
Test procedure submitted to CNSC and TSSA	To be completed prior to filling the vessel with water.
Fitness-for-Service (FFS) Evaluation	
Preliminary FFS evaluation submitted to CNSC for acceptance, including acceptance criteria as per section 8.2.1 of N285.4.	Draft submitted ore-repair. Rev 0 submitted during repair
Final FFS evaluation	Post repair, 90 days after return to service

APPENDIX C

DELIVERABLES CONTAINED IN THE NRU RESTART PROTOCOL

Deliverables Contained in the NRU Restart Protocol

Protocol Deliverable	Section Deliverable Content	1				2					3	4		5				6	Submission Date of R0 to CNSC Staff					
		Bullet	1	2	3	4	1	2	3	4	5	6	7	8	9	1	2	1		2	3	4	1	
Vessel Over-Pressure Protection Report	A revised reactor vessel over-pressure protection report (or justification for not revising the OPPR).							X																Completed December 23
Dispositions and Code Cases Letter	Details of any dispositions or use of code cases that will be requested.										X													Completed on October 15
Repair Report	Proof that codes, standards and processes for repair, as well as TSSA acceptances, have been obtained. Also will contain the results of post-repair inspections to confirm fitness for service. ITP signed off Post-repair NDE													X	X	X								10 days after completion of repair.
Vessel In Service Inspection Program	A revised periodic inspection program that includes the reactor vessel.															X								Completed December 24
Fitness for Service Assessment	A preliminary Fitness for Service evaluation prior to refuelling approval. Final Fitness for Service report 90 days after return to service.																		X					Preliminary R0 December 2. Update January 22 Final R0: 90 days after return to service.
Vessel Life Assessment Report	1. Identifies and addresses the gaps in the Vessel Condition Assessment report prepared for the 2005 NRU licence extension. 2. Letter identifying any gaps in the remaining Condition Assessment reports. If required, disposition of any safety related issues.																				X			Vessel Condition Assessment Completed November 24. Letter regarding remaining condition assessments on January 22.
Extended Activities Plan	The activities conducted under the extended activities plan during the outage, and justification for deferral of any activities that will require a later defuelling or a later extended outage.																					X		To be provided as a monthly update.

Protocol Sections:

- 1. Assessment
- 2. Repair

- 3. Post-Repair Inspection
- 4. Mitigation of Degradation

- 5. Readiness for Service
- 6. Other Outage Work

Note: The dates supplied are consistent with the current outage schedule and there are a number of outstanding schedule risks that have not been dispositioned. Therefore, the dates provided will be subject to change if completion of the vessel repair is delayed or brought forward.