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24-1-0-1

NUCLEAR RESEARCH AND TEST ESTABLISHMENT OPERATING LICENCE

CHALK RIVER LABORATORIES

Unless otherwise provided for in this licence, words and expressions used in this licence have the same meaning as in the *Nuclear Safety and Control Act* and associated regulations.

- I) **LICENCE NUMBER:** **NRTEOL-01.00/2011**
- II) **LICENSEE:** Pursuant to Section 24 of the *Nuclear Safety and Control Act*, this licence is issued to
- Atomic Energy of Canada Limited–
Énergie atomique du Canada ltée
2251 Speakman Drive
Mississauga, Ontario
L5K 1B2**
- III) **LICENCE PERIOD:** This licence is valid from **August 1, 2006, to October 31, 2011**, unless suspended, amended, revoked or replaced.
- IV) **LICENSED ACTIVITIES:**

This licence authorizes the licensee, Atomic Energy of Canada Limited – Énergie atomique du Canada ltée (hereinafter “AECL”), to

- a) operate the Chalk River Laboratories (hereinafter “CRL”) located on the site described in the schedule to Atomic Energy Control Board Order 1/14/74, dated June 4, 1974, published in Part I of the Canada Gazette for June 8, 1974, and including the facilities described in Appendix B and Appendix C to this licence, in the documents cited therein and in the document entitled *Information in Support of Site Licence Renewal for Chalk River Laboratories*, numbered CRL-00521-LP-001, Revision 0, dated December 2005 (hereinafter “CRL-00521-LP-001”) and listed in Appendix A to this licence;

- b) produce, possess, process, refine, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in a);
- c) possess, use, produce and transfer prescribed equipment that is required for, associated with, or arises from the activities described in a);
- d) possess, use and transfer prescribed information that is required for, associated with, or arises from the activities described in a); and
- e) import any nuclear substance within the following limitations: For its valid period, this licence does not authorize the licensee to import deuterium, heavy water (deuterium oxide) or any other deuterium compound in which the ratio of deuterium to hydrogen atoms exceeds 1:5,000 or to import, during any calendar year, more than
 - i) 37 TBq of tritium;
 - ii) 1 GBq of plutonium;
 - iii) 2 MBq of thorium 228 or 232;
 - iv) 200 MBq of enriched uranium 233;
 - v) 37 kBq of enriched uranium 235;
 - vi) 6 MBq of natural uranium; or
 - vii) 6 MBq of depleted uranium, except when incorporated as shielding in a radiation device.

V) CONDITIONS:

1. GENERAL

- 1.1 The Canadian Nuclear Safety Commission (hereinafter “the Commission”) or a person authorized by the Commission is the sole authority to interpret the conditions of this licence.
- 1.2 The contents of the appendices attached to this licence form part of the licence.
- 1.3 Unless otherwise indicated in this licence, the licensee shall not make any change to any of the documents listed in Appendices A, B and C to this licence without the prior written approval of the Commission or a person authorized by the Commission.

Amendment of the licence is not required prior to the licensee’s implementation of a proposed change that has been approved in writing by the Commission or a person authorized by the Commission. An approved change is deemed to be part of this licence.

- 1.4 Unless otherwise indicated in this licence, the licensee may make any change to AECL’s compliance and additional program manual documents cited in CRL-00521-LP-001, and not listed in Appendices A, B, or C to this licence, provided the changes are made in accordance with the requirement that, before a change can be made, it must be justified and subjected to the same level of review and approval within AECL as was originally obtained.

- 1.5 The licensee shall not change the ownership, possession or use of lands described in the schedule to Atomic Energy Control Board Order 1/14/74, dated June 4, 1974, published in Part I of the Canada Gazette for June 8, 1974, without the prior written approval of the Commission or a person authorized by the Commission.
- 1.6 The licensee shall provide, at the CRL site and at no expense to the Commission, office space for employees of the Commission who customarily carry out their functions on the premises of the CRL site (on-site Commission staff). The licensee shall keep the office space of on-site Commission staff separate from the remainder of the building in which it is located by walls, partitions or other suitable structures.

2. STAFFING AND ORGANIZATION

- 2.1 The licensee shall not make any change to the following National Research Universal (NRU) Reactor organization documents without the prior written approval of the Commission or a person authorized by the Commission:

- a) *Senior Reactor Shift Engineer Roles and Responsibilities* listed in Appendix A to this licence; and
- b) *NRU Health Physicist Roles and Responsibilities* listed in Appendix A to this licence.

- 2.2 The licensee shall maintain the staff complement at the NRU Reactor, including the minimum reactor shift complement, as specified in the document entitled *Facility Authorization for the Operation of the NRU Reactor at the Chalk River Laboratories*, AECL-FA-01, listed in Appendix B to this licence.

The minimum personnel requirements for the NRU Reactor control room that this condition imposes do not apply where this minimum cannot be met due to emergency conditions that could cause an unwarranted hazard to personnel in the NRU Reactor control room. In this case, the licensee shall place the reactor in an assured shutdown and safe condition.

- 2.3 Any person that the licensee appoints to the position of NRU Health Physicist must hold a certification issued pursuant to the *Nuclear Safety and Control Act*.
- 2.3.1 Any person appointed to the position of NRU Health Physicist shall not delegate the authority or responsibilities of the position, except to another individual who holds a certification as NRU Health Physicist delegate issued pursuant to the *Nuclear Safety and Control Act*.
- 2.3.2 When applying for Commission certification of a person as an NRU Health Physicist, the licensee shall confirm that the person
- a) has safely and competently performed the duties of an NRU Health Physicist for the preceding four years;

- b) has received the applicable continuing training specified in Appendix F to this licence;
 - c) has successfully completed an interview by CRL radiation protection management that confirms and documents the person's competence to perform the duties of an NRU Health Physicist; and
 - d) is capable, in the opinion of the licensee, of performing the duties of an NRU Health Physicist.
- 2.3.3 When applying for certification as an NRU Health Physicist, or as a delegate for the position, of any person not covered in 2.3.2, the licensee shall confirm that the person meets the applicable requirements specified in Appendix E to this licence.
- 2.3.4 When applying for renewal of a certification of a person as a NRU Health Physicist, the licensee shall confirm that the person
- a) has safely and competently performed the duties of a NRU Health Physicist;
 - b) has received the applicable continuing training specified in Appendix F to this licence;
 - c) has completed, within six months prior to the expiry date of their certification, an interview conducted by Commission staff, as specified in Appendix F, Subsection 2.2; and
 - d) is capable, in the opinion of the licensee, of performing the duties of the NRU Health Physicist.
- 2.4 Any person that the licensee appoints to the position of Senior Reactor Shift Engineer at the NRU Reactor must hold a certification issued pursuant to the *Nuclear Safety and Control Act*.
- 2.4.1 When applying for Commission certification of a person as a Senior Reactor Shift Engineer at the NRU Reactor, the licensee shall confirm that the person
- a) has safely and competently performed the duties of a Senior Reactor Shift Engineer at the NRU Reactor for at least the preceding two years;
 - b) has received the applicable continuing training specified in Appendix F to this licence;
 - c) has successfully completed an interview by NRU Reactor management that confirms and documents the person's competence to perform the duties of the Senior Reactor Shift Engineer; and

- d) is capable, in the opinion of the licensee, of performing the duties of the Senior Reactor Shift Engineer.
- 2.4.2 When applying for certification as Senior Reactor Shift Engineer of any person not covered in 2.4.1, the licensee shall confirm that the person meets the applicable requirements specified in Appendix D to this licence.
- 2.4.3 When applying for renewal of a certification of a person as a Senior Reactor Shift Engineer at the NRU Reactor, the licensee shall confirm that the person
- a) has safely and competently performed the duties of a Senior Reactor Shift Engineer at the NRU Reactor;
 - b) has received the applicable continuing training specified in Appendix F to this licence;
 - c) has completed, within six months prior to the expiry date of their certification, a written requalification test as specified in Appendix F, Subsection 2.1; and
 - d) is capable, in the opinion of the licensee, of performing the duties of the Senior Reactor Shift Engineer.
- 2.5 The licensee shall ensure that certified Senior Reactor Shift Engineers at the NRU Reactor and certified NRU Health Physicists receive the continuing training and complete the requalification tests specified in Appendix F to this licence.
- 2.6 The licensee shall, by August 1, 2007, establish and document the required initial and continuing training programs to address the training requirements referred to in Appendices D, E and F to this licence. These programs shall be in accordance with the principles of a systematic approach to training.
- 2.7 The licensee shall ensure that certified Senior Reactor Shift Engineers and certified NRU Health Physicists, who are assigned to other positions at CRL, maintain competence by attending the required continuing training (as specified in Appendix F to this licence) and performing the duties of the position for a minimum of one complete shift (normal work hours in a day for that position) every 42 days.
- 2.8 The licensee shall ensure that Senior Reactor Shift Engineers and NRU Health Physicists, assigned to their certified positions, maintain competence by attending the required continuing training (as specified in Appendix F to this licence) and performing the duties of the position for a minimum of three complete shifts per calendar quarter and for a minimum of 50 complete shifts over a three-year period.
- 2.9 The licensee shall immediately remove a person from the duties of Senior Reactor Shift Engineer or NRU Health Physicist under the following conditions:
- a) the person has failed any requalification test referred to in Appendix F to this licence;

- b) the person, while temporarily assigned to another position at CRL, has not acted as Senior Reactor Shift Engineer or NRU Health Physicist for the minimum number of complete shifts specified in conditions 2.7 or 2.8 of this licence, as appropriate;
 - c) the person and the licensee have been informed in writing that the Commission has initiated procedures for the decertification of the person; or
 - d) the person is not capable, in the opinion of the licensee, of performing the duties of the position.
- 2.10 The licensee may reinstate a person who has been removed from the duties of Senior Reactor Shift Engineer or NRU Health Physicist under conditions 2.9 a), b), c) or d) of this licence, to the duties of the position if the person has met the following requirements, as applicable:
- a) the person has met the requalification requirements specified in Appendix F to this licence;
 - b) the person has successfully completed a training and evaluation program that gives assurance to the licensee that the person can again perform the duties of the position competently and safely; this program shall be based on a documented assessment by the licensee of the impact of the removal on the competence of the person; or
 - c) the licensee has been informed in writing of the Commission decision not to decertify the person.

3. OPERATIONS

- 3.1 Unless otherwise indicated in this licence, the licensee shall operate CRL in accordance with the documents listed in Appendix A and Appendix B to this licence and with AECL's compliance and additional program manual documents cited in CRL-00521-LP-001, as revised in accordance with condition 1.4 of this licence.
- 3.2 Unless otherwise approved in writing by the Commission or a person authorized by the Commission, the licensee shall test every system associated with a facility listed in Appendix B to this licence at a frequency to substantiate the reliability that is claimed or implied in the document respecting that facility listed in Appendix B.
- 3.3 Unless otherwise approved in writing by the Commission or a person authorized by the Commission, the licensee shall maintain every facility listed in Appendix B to this licence at a standard and frequency to substantiate the reliability and effectiveness that is claimed or implied in the document respecting that facility listed in Appendix B.
- 3.4 The licensee shall, by December 31, 2007, revise the facility authorizations (FAs) listed in Appendix B to this licence to ensure they are accurate, current and consistent. The FAs shall be reviewed, revised as appropriate, and reissued every five years.

- 3.5 The licensee shall review, revise and update as required the Final Safety Analysis Reports (FSARs) for the facilities listed in Appendix B to this licence every five years.

The updated FSARs shall include: 1) a description of the changes made to the facility structures, systems and components (SSCs), including any changes to the design and operating conditions of SSCs; 2) safety analyses that have been appropriately reviewed and revised, and that take into account the most up-to-date and relevant information and methods, including the experience gained and lessons learned from situations, events, and problems.

- 3.6 For the purpose of limiting, during the lifetime of the nuclear facilities on the CRL site, the risks related to the failure or unavailability of any structure, system or component whose performance may affect the safe operation or security of the nuclear facility, the licensee shall establish, document and implement a maintenance program.

The maintenance program shall include testing and inspection and shall be of such quality and be performed in such a manner that the availability, reliability and effectiveness of any structure, system or component remain consistent with the design and analysis documents referenced in the documents listed in Appendices A, B and C to this licence.

4. MODIFICATIONS

- 4.1 The licensee shall not construct, install or modify any facility, building, structure, component or equipment described in the documents listed in Appendix B or Appendix C to this licence if that construction, installation or modification would render inaccurate the information contained in those documents, result in adverse impact on health, safety or the environment that is different in nature or greater in probability than that described in those documents, or otherwise adversely affect the safe conduct of the activities described in Part IV of this licence, without the prior written approval of the Commission or a person authorized by the Commission.

- 4.2 The licensee shall not make modifications to, or deviate from the design, operating conditions, purposes, methods, procedures or limits described in the documents listed in Appendix B or Appendix C to this licence that would render inaccurate the information contained in those documents, result in an adverse impact on health, safety or the environment that is different in nature or greater in magnitude or probability than that described in those documents, or otherwise adversely affect the safe conduct of the activities described in Part IV of this licence, without the prior written approval of the Commission or a person authorized by the Commission.

5. OPERATING FACILITIES IN A STORAGE-WITH-SURVEILLANCE STATE

- 5.1 The licensee shall not start to decommission any nuclear facility at CRL unless the decommissioning project is in accordance with the approved decommissioning plan(s) and documents listed opposite the facility in column 2 of Appendix C to this licence and prior written approval of the Commission or a person authorized by the Commission has been received.
- 5.2 For facilities listed in Appendix C to this licence, the licensee shall, unless otherwise indicated in this licence, undertake maintenance, monitoring and surveillance activities in accordance with the documents listed opposite the facility in column 2 of Appendix C to this licence and with AECL's compliance and additional program manual documents cited in CRL-00521-LP-001, as revised in accordance with condition 1.4 of this licence.
- 5.3 For any operating facility in a storage-with-surveillance state or part of such facility for which documents are not yet listed opposite the facility in column 2 of Appendix C to this licence and unless otherwise specified in a monitoring and surveillance plan approved by the Commission or a person authorized by the Commission, the licensee shall
- a) inspect the shutdown facility daily (weekdays) to assure that the safe shutdown state is being maintained;
 - b) not introduce into the facility materials or equipment that are not related to maintaining the safe shutdown state of the facility; and
 - c) not carry out any activity that is not related to maintaining the facility in its safe shutdown state.
- 5.4 Unless otherwise approved in writing by the Commission or a person authorized by the Commission, the licensee shall test every system associated with a facility listed in column 1 of Appendix C to this licence at a frequency to substantiate the reliability that is claimed or implied in the document listed opposite the facility in column 2 of Appendix C.

6. PRESSURE BOUNDARIES

For the purposes of the following conditions of this section, "registered", "accepted", "approval" and "approved" means either by the Commission, by a person authorized by the Commission, or by an authority identified by the Commission for that purpose.

- 6.1 Subject to condition 6.2 of this licence, the licensee shall design, manufacture, fabricate, procure, install, modify, repair, test, examine, inspect, or otherwise perform work related to vessels, boilers, systems, piping, fittings, parts, components, and supports according to the specifications in CSA Standards N285.0-95 and B51-97 or in other codes and standards approved or prescribed by the Commission. For code classification, the licensee shall apply the rules in CSA Standard N285.0-81. Where indicated by these standards, the licensee shall obtain the following regulatory approvals for this work:

- a) registered designs;
 - b) accepted overpressure protection reports;
 - c) approval of applicable standards and code classification;
 - d) registered welding and brazing procedures;
 - e) qualified welders, welding operators, brazers, and examination personnel;
 - f) accepted quality assurance programs; and
 - g) accepted plans and procedures.
- 6.2 The licensee may, in accordance with AECL Procedure No. 120-541.3 listed in Appendix A to this licence, carry out the activities listed in condition 6.1 of this licence in accordance with the *Boiler and Pressure Vessels Regulations, Ontario Technical Standards and Safety Act, 2000*, and associated regulations, as amended, for pressure boundary systems and components that do not contain nuclear substances, do not adversely impact a nuclear safety system or do not cause an unacceptable risk involving nuclear substances at CRL.
- 6.3 The licensee shall operate vessels, boilers, systems, piping, fittings, parts, components, and supports safely and keep them in a safe condition. The licensee shall
- a) follow approved plans and procedures to test, maintain, or alter overpressure protection devices;
 - b) comply with operating limits specified in certificates, orders, designs, overpressure protection reports, and applicable codes and standards;
 - c) inspect and perform material surveillance according to
 - accepted schedules, plans and procedures for facilities on the CRL site, including non-power reactors less than 5 megawatts thermal (MWth);
 - the technical requirements in CSA Standard N285.4-94 and accepted schedules, plans and procedures for non-power reactors of 5 MWth or more;
 - d) have any certified boiler or vessel that is in operation or use inspected and certified by an authorized inspector according to an accepted schedule; and
 - e) ensure that vessels, boilers, systems, piping, fittings, parts, components, and supports have markings as specified in the applicable standards.
- 6.4 The licensee shall keep proper records of regulatory approvals and other documents required under conditions 6.1 and 6.3 of this licence and the standards applicable to the work or equipment.

6.5 In addition to any reporting requirements set out in condition 10.1 of this licence or in the *Nuclear Safety and Control Act* and its associated regulations, the licensee shall report promptly to the Commission and to the Ontario Technical Standards and Safety Authority when the licensee becomes aware of a failure of a pressure boundary that has caused injury, death or property damage.

7. RADIATION AND ENVIRONMENTAL PROTECTION

7.1 The licensee shall operate and maintain CRL according to the methods and procedures, for the purposes and within the limits set out in *AECL's Radiation Protection Requirements*, listed in Appendix A to this licence.

7.2 The radiation emergency procedures shall be governed by and be in accordance with the *Chalk River Laboratories Site Emergency Plan*, listed in Appendix A to this licence.

7.3 The licensee shall control, monitor and record releases of radioactive nuclear substances from CRL, and such releases shall not exceed the limits identified in the document *Derived Release Limits for Airborne and Liquid Effluents From Chalk River Laboratories During Normal Operations*, listed in Appendix A to this licence.

7.4 The licensee shall control, monitor and record releases of hazardous substances from CRL.

7.5 The licensee shall, by November 30, 2006,

- a) review and, if necessary, revise the Environmental Management System for AECL Sites in Canada, RC-2000-021-0.0, to conform to the requirements of Regulatory Standard S-296, *Environmental Protection Policies, Programs and Procedures at Class I Nuclear Facilities and Uranium Mines and Mills*; and
- b) provide an action plan to address any gaps between the program implementation and S-296.

7.6 The licensee shall revise the *Action Levels* document listed in Appendix A to this licence to reflect previous years' operational performance, taking into account the following:

- a) each facility listed in Appendices B and C to this licence shall have action levels;
- b) all verification monitoring discharge points shall have action levels;
- c) action levels shall be written into the facility operating procedures; and
- d) this revision shall be completed and the action levels shall be in place by July 31, 2007.

7.7 All follow-up monitoring programs identified as a result of Environmental Assessments shall be progressed to completion and the progress reported to the Commission in accordance with condition 10.6 of this licence.

- 7.8 The licensee shall
- a) submit, by July 31, 2007, an integrated environmental monitoring program that includes a site-wide groundwater monitoring program; and
 - b) implement the program by December 31, 2008.
- 7.9 The licensee shall not make any controlled liquid releases, identified in conditions 7.3 and 7.4 of this licence, to the ground on the CRL site.
- 7.10 The licensee shall, by December 31, 2006, remove the glass blocks placed in the ground as an experiment to measure radionuclide dispersion characteristics.
- 7.11 The licensee shall, by July 31, 2007,
- a) develop an action plan to characterize all the identified areas of land that have been contaminated by radioactive or hazardous substances (hereinafter "affected lands");
 - b) develop plans for monitoring, mitigation or remediation of affected lands; and
 - c) verify that all affected lands and potential sources of contaminants have been identified and characterized.
- 7.12 The licensee shall, by July 31, 2007, develop and maintain a program to
- a) characterize all identified plumes in terms of their spatial distribution and loadings of radioactive and hazardous substances to the environment and their potential environmental effects;
 - b) assess the adequacy of current groundwater monitoring activities; and
 - c) include when necessary, based on assessed environmental impacts, plume remediation/reduction activities.
- 7.13 The licensee shall, by March 31, 2007, install on the Building 109 stack a real-time sampling and monitoring system (equipment) for argon-41.
- 7.14 The licensee shall, by December 31, 2007, establish and submit for approval by the Commission or a person authorized by the Commission, out-of-service criteria for all controlled release point verification monitoring equipment which must include, as a minimum,
- a) the maximum time equipment is allowed to be out of service; and
 - b) the process for estimating the magnitude of any releases during the period when monitoring equipment was out of service.

- 7.15 The licensee shall, by December 31, 2007, produce liquid effluent release point flow diagrams for all release points to the Ottawa River.
- 7.16 The licensee shall, by October 1, 2007, review and, if necessary, revise and reissue AECL Document No. RC-1731, *Derived Release Limits for Airborne and Liquid Effluents from Chalk River Laboratories During Normal Operations*.
- The document shall be reviewed and, if necessary, revised and reissued every five years.
- 7.17 The licensee shall, by December 31, 2006, produce a mercury mass balance for the Molybdenum-99 Production Facility.
- 7.18 The licensee shall include the future Sewage Sludge Landfill in a new facility authorization or in a facility authorization listed in Appendix B to this licence.

8. SAFEGUARDS

- 8.1 The licensee shall take all necessary measures to facilitate Canada's compliance with any applicable safeguards agreement.
- 8.2 The licensee shall provide the International Atomic Energy Agency (hereinafter "IAEA"), an IAEA inspector, or a person acting on behalf of the IAEA, with such reasonable services and assistance as are required to enable the IAEA to carry out its duties and functions pursuant to a safeguards agreement.
- 8.3 The licensee shall grant prompt access at all reasonable times to all locations at CRL to an IAEA inspector, or to a person acting on behalf of the IAEA, where such access is required for the purposes of carrying on an activity pursuant to a safeguards agreement. In granting access, the licensee shall provide health and safety services and escorts as required in order to facilitate activities pursuant to a safeguards agreement.
- 8.4 The licensee shall disclose to the Commission, to the IAEA, or to an IAEA inspector, any records that are required to be kept or any reports that are required to be made under a safeguards agreement.
- 8.5 The licensee shall provide such reasonable assistance to an IAEA inspector, or to a person acting on behalf of the IAEA, as is required to enable sampling and removal or shipment of samples required pursuant to a safeguards agreement.
- 8.6 The licensee shall provide such reasonable assistance to an IAEA inspector, or to a person acting on behalf of the IAEA, as is required to enable measurements, tests and removal or shipment of equipment required pursuant to a safeguards agreement.
- 8.7 The licensee shall, at the request of the Commission or a person authorized by the Commission, install safeguards equipment at CRL.

- 8.8 The licensee shall permit an IAEA inspector, or a person acting on behalf of the IAEA, to service safeguards equipment at CRL.
- 8.9 The licensee shall operate safeguards equipment at CRL in accordance with the methods and procedures specified by the IAEA.
- 8.10 The licensee shall provide the services required for the operation of the safeguards equipment at CRL, in accordance with the specifications of the IAEA.
- 8.11 The licensee shall not interfere with or interrupt the operation of safeguards equipment at CRL or alter, deface or break a safeguards seal, except pursuant to a safeguards agreement.
- 8.12 The licensee shall implement measures to prevent damage to or the theft, loss or sabotage of safeguards equipment or samples collected pursuant to a safeguards agreement or the illegal use, possession, operation or removal of such equipment or samples.
- 8.13 The licensee shall make such reports and provide such information to the Commission, as are required to facilitate Canada's compliance with any applicable safeguards agreement.
- 8.14 The licensee shall not, except with the prior written approval of the Commission or a person authorized by the Commission, make changes to any aspect of CRL or its operation, equipment or procedures that would affect the implementation of safeguards measures.
- 8.15 The licensee shall make and submit to the Commission, in accordance with document AECB-1049, *Reporting Requirements for Fissionable and Fertile Substances*, reports on the inventory and transfer of fissionable and fertile substances.

9. NUCLEAR SUBSTANCES

- 9.1 For nuclear substances other than those cited in condition 8.15 of this licence, the licensee shall keep records that describe fully and accurately
- a) the amount and type of nuclear substances released from CRL into the environment;
 - b) the amount, type and location of nuclear substances placed into or removed from each waste management area at CRL; and
 - c) the production, acquisition and disposition of nuclear substances other than those cited in a) and b).

10. REPORTING

10.1 The licensee shall immediately make reports to the Commission of any

- a) failure of equipment or procedures which led to or which, in the absence of safety systems provided, could have led to fuel failure in a reactor or any release of nuclear substances from any facility listed in Appendix B or Appendix C to this licence exceeding the derived release limits cited in condition 7.3 of this licence;
- b) failure of a protective system which did prevent or could have prevented the system from performing in accordance with the documents cited in condition 1.2 of this licence;
- c) inaccuracy or incompleteness in the documents cited in condition 1.2 of this licence that could affect the results of the safety assessments in those documents;
- d) discovery of a hazard different in nature or greater in probability or magnitude than that described in the documents cited in condition 1.2 of this licence;
- e) failure of any building structure; and
- f) discovery of an unauthorized release of a radioactive or hazardous substance to the environment.

10.2 The licensee shall prepare and submit to the Commission, at the intervals specified in conditions 10.3 and 10.4 of this licence, written reports that cover

- a) the operation and maintenance of the facilities listed in Appendix B to this licence, summarizing facility and equipment performance and changes, changes to operating policies, changes in organization, occurrences described in condition 10.1 of this licence, occurrences reported under the requirements of the *Nuclear Safety and Control Act* and its associated regulations, personnel radiation exposures, releases of nuclear substances from the facilities, and releases of hazardous substances from the facilities;
- b) the status of the facilities listed in Appendix C to this licence, summarizing facility and equipment performance and changes, changes to operating policies, changes in organization, occurrences described in condition 10.1 of this licence, occurrences reported under the requirements of the *Nuclear Safety and Control Act* and its associated regulations, personnel radiation exposures, releases of nuclear substances from the facilities, and releases of hazardous substances from the facilities;
- c) changes to the emergency authorities and organization, updates or changes to the radiation emergency procedures cited in condition 7.2 of this licence, status of and changes in other program documentation, training activities, drill and exercise activities, status of emergency resources and facilities, interactions with outside agencies, and unplanned events that tested the emergency response organization;

- d) the results of the effluent monitoring for radioactive nuclear substances cited in condition 7.3 of this licence, the effluent monitoring for hazardous substances cited in condition 7.4 of this licence and personnel radiation exposures for CRL; and
 - e) the results of environmental monitoring for nuclear substances and hazardous substances.
- 10.3 The licensee shall, by March 31 of each calendar year, submit to the Commission the reports described in conditions 10.2 a), 10.2 b), 10.2 c), and 10.2 d) of this licence covering the preceding calendar year.
- 10.4 The licensee shall, by April 30 of each calendar year, submit to the Commission the reports described in condition 10.2 e) of this licence covering the preceding calendar year.
- 10.5 Subject to condition 7.6 of this licence, if any action level set out in Attachments 1, 2 and 3 to the March 19, 2002, letter entitled *Action Levels*, from R.P. Lambert of AECL to W. Glenn Martin of the CNSC, listed in Appendix A to this licence, is reached or exceeded, the licensee shall notify the Commission within seven working days of becoming aware of the matter and shall file a final written report with the Commission within 45 working days of becoming aware of the matter.
- 10.6 The licensee shall, by December 1 of each calendar year, submit to the Commission the reports described in condition 7.7 of this licence covering the 12-month period up to and including the previous July 31.
- 10.7 For a twelve-month trial period starting December 31, 2006, the licensee shall make reports in accordance with Regulatory Standard S-99, *Reporting Requirements for Operating Nuclear Power Plants*, except for Subsections 6.3.2.3, 6.4.1, 6.4.2, 6.4.3, 6.4.4, 6.4.6, 6.4.9, 6.4.10, and 6.4.11. Where Regulatory Standard S-99 refers to 'nuclear power plant', the requirement shall be applied to the entire CRL site.
11. FIRE PROTECTION
- 11.1 The licensee shall design, build, modify and otherwise carry out work related to facilities on the CRL site (including non-power reactors of less than 5 MWth) with potential to impact protection from fire in accordance with the *National Building Code of Canada, 2005*, the *National Fire Code of Canada, 2005*, and *National Fire Protection Association NFPA-801, Standard for Facilities Handling Radioactive Materials, 2003 edition*.

- 11.2 The licensee shall design, build, modify, and otherwise carry out work related to non-power reactor (5 MWth or more) facilities on the CRL site in accordance with the *National Building Code of Canada, 2005*, the *National Fire Code of Canada, 2005*, the *National Fire Protection Association NFPA-801, Standard for Facilities Handling Radioactive Materials, 2003 edition*, and *CSA Standard CSA N293-95: Fire Protection for CANDU Nuclear Power Plants*, and Appendices A to D of that standard inclusive as interpreted as applying to the facility.
- 11.3 The licensee shall operate, maintain, test, and inspect the facilities on the CRL site (including non-power reactors of less than 5 MWth) in accordance with the *National Fire Code, 2005*, and *NFPA-801, 2003 edition*.
- 11.4 The licensee shall operate, maintain, test, and inspect the non-power reactor (5 MWth or more) facilities in accordance with
- a) the *National Fire Code, 2005*, and *NFPA-801, 2003 edition*, until December 31, 2007; and
 - b) the *National Fire Code, 2005*, *NFPA-801, 2003 edition*, and *CSA Standard N293-95* and Appendices A to E of that standard inclusive as interpreted as applying to the facility, after December 31, 2007.
- 11.5 The licensee shall, prior to implementing any proposed modification to the facilities on the CRL site with potential to impact protection from fire,
- a) submit the proposed modification for third-party review of compliance with conditions 11.1 and 11.2 of this licence and the standards listed therein;
 - b) have the review carried out by one or more independent external agencies having specific expertise with such reviews; and
 - c) submit the results of the review in writing to the Commission.
- 11.6 The licensee shall
- a) arrange for an annual third-party review of compliance with conditions 11.3 and 11.4 of this licence and the standards listed therein;
 - b) have the review carried out by an independent external agency having specific expertise with such reviews; and
 - c) submit the results of the review in writing to the Commission.
- 11.7 In the event of any conflict or inconsistency between the above requirements and any requirement of the Commission pursuant to the *Nuclear Safety and Control Act* and its regulations, the licensee shall refer the matter to the Commission or a person authorized by the Commission for resolution.

12. SECURITY

- 12.1 The licensee shall maintain the measures for security at CRL as specified in the *Chalk River Laboratories, Site Security Report*, listed in Appendix A to this licence.
- 12.2 The licensee shall establish, train, test, equip, and deploy a nuclear response force in accordance with Regulatory Standard S-298, *Nuclear Response Force Standard*.

13. QUALITY ASSURANCE

- 13.1 The licensee shall implement a quality assurance program that conforms to the requirements of the following CSA Standards:
- a) CAN/CSA-N286.0-92: *Overall Quality Assurance Program Requirements for Nuclear Power Plants*;
 - b) CAN3-N286.1-00: *Procurement Quality Assurance for Nuclear Power Plants*;
 - c) CAN3-N286.2-00: *Design Quality Assurance for Nuclear Power Plants*;
 - d) CAN3-N286.3-99: *Construction Quality Assurance for Nuclear Power Plants*;
 - e) CAN/CSA-N286.4-M86: *Commissioning Quality Assurance for Nuclear Power Plants*;
 - f) N286.5-95: *Operations Quality Assurance for Nuclear Power Plants*;
 - g) N286.6-98: *Decommissioning Quality Assurance for Nuclear Power Plants*; and
 - h) N286.7-99 (R2003): *Quality Assurance for Analytical, Scientific and Design Computer Programs for Nuclear Power Plants*.

14. CRITICALITY SAFETY

- 14.1 The licensee shall carry out operations with fissionable materials outside reactors such that the Upper Subcritical Limits established in the criticality safety documents will not be exceeded under both normal and credible abnormal conditions.

14.2 The licensee shall, before December 31, 2006, develop and submit for approval by the Commission or a person authorized by the Commission, nuclear criticality safety program(s) that conform to

- 1) The applicable requirements of the following set of the ANSI/ANS-8 series of standards:
 - a) ANSI/ANS-8.1-1998: *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*;
 - b) ANSI/ANS-8.3-1997 (R2003): *Criticality Accident Alarm System*;
 - c) ANSI/ANS-8.5-1996 (R2002): *Use of Borosilicate-Glass Raschig Rings as Neutron Absorber in Solutions of Fissile Material*;
 - d) ANSI/ANS-8.6-1983 (R2001): *Safety in Conducting Subcritical Neutron-Multiplication Measurements In Situ*;
 - e) ANSI/ANS-8.7-1998: *Nuclear Criticality Safety in the Storage of Fissile Materials*;
 - f) ANSI/ANS-8.9-1987 (R1995): *Nuclear Criticality Safety Guide for Steel-Pipe Intersections Containing Aqueous Solutions of Enriched Uranyl Nitrate*;
 - g) ANSI/ANS-8.10-1983 (R1999): *Criteria for Nuclear Criticality Safety Controls in Operations With Shielding and Confinement*;
 - h) ANSI/ANS-8.12-1987 (R2002): *Nuclear Criticality Control and Safety of Plutonium-Uranium Fuel Mixtures Outside Reactors*;
 - i) ANSI/ANS-8.14-2004: *Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors*;
 - j) ANSI/ANS-8.15-1981 (R1995): *Nuclear Criticality Control of Special Actinide Elements*;
 - k) ANSI/ANS-8.17-2004: *Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors*;
 - l) ANSI/ANS-8.19-1996: *Administrative Practices for Nuclear Criticality Safety*;
 - m) ANSI/ANS-8.20-1991 (R1999): *Nuclear Criticality Safety Training*;
 - n) ANSI/ANS-8.21-1995 (R2001): *Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors*;

- o) ANSI/ANS-8.22-1997: *Nuclear Criticality Safety Based on Limiting and Controlling Moderators*; and
 - p) ANSI/ANS-8.23-1997: *Nuclear Criticality Accident Emergency Planning and Response*.
- 2) The following additional requirements:
- a) The licensee shall establish an adequate margin of subcriticality to comply with the requirements of Section 4.1.2 of ANSI/ANS-8.1-1998 such that
 - if calculational methods are applied to predict neutron multiplication factors for safety assessment, the margin of subcriticality shall be calculated using formulas presented in attachment C to ANSI/ANS-8.1-1998, and a minimum value for an administrative margin of subcriticality, as presented in the formulas for calculation of subcriticality, shall be 5% in neutron multiplication factor; and
 - if calculational methods are not applied to predict neutron multiplication factors for safety assessment, a minimum value for an administrative margin of subcriticality shall be 20% of the critical mass.
 - b) The licensee shall maintain the established adequate margin of subcriticality under all normal and credible abnormal conditions to comply with the requirements of Section 4.1.2 of ANSI/ANS-8.1-1998 such that
 - all credible abnormal conditions (events or event sequences having frequency of occurrence equal to or more than 10^{-6} /year) are identified and assessed; and
 - the frequency of occurrence for the identified credible abnormal conditions is clearly demonstrated using quantitative or semi-quantitative methods.
 - c) The licensee shall demonstrate that adequate mitigation measures are put in place such that off-site consequences of a criticality accident, as calculated from the start of the accident, do not violate criteria established as a trigger for a temporary public evacuation by the following international standard and national guidance:
 - *Preparedness and Response for a Nuclear or Radiological Emergency, Safety Requirements*, Safety Standards Series No. GS-R-2, IAEA, Vienna, Austria, 2002, Annex III, Subsection III-2; and
 - *Canadian Guidelines for Intervention during a Nuclear Emergency*, Document H46-2/03-326E, Health Canada, Ottawa, Ontario, 2003 November.

14.3 The licensee shall, by December 31, 2006, develop and submit for approval by the Commission or a person authorized by the Commission, the schedule for implementation of the nuclear criticality safety program(s) identified in condition 14.2 of this licence, including updates of the criticality safety documents.

14.4 The licensee may implement the requirements of condition 14.2 of this licence on a risk-graded approach starting with high priority nuclear criticality safety program(s).

15. DECOMMISSIONING FINANCIAL GUARANTEE

15.1 The licensee shall review, revise and update as required the Comprehensive Preliminary Decommissioning Plan for CRL every five years, or when required due to evolving technologies, regulations, operational information or cost estimates.

15.2 The licensee shall maintain in effect a financial guarantee for decommissioning acceptable to the Commission or a person authorized by the Commission.

16. CODES AND STANDARDS

16.1 Unless otherwise permitted by the prior written approval of the Commission or a person authorized by the Commission, the licensee shall, in respect of the licence condition set out in column 4, follow the requirements of the codes/standards edition set out in column 3 of the table below.

Column 1	Column 2	Column 3	Column 4
Document Number	Title	Edition	Licence Condition
N285.0	General Requirements for Pressure-Retaining Systems and Components in CANDU Nuclear Power Plants	1995	6.1
B51	Boiler, Pressure Vessel, and Pressure Piping Code	1997	6.1
N285.0	General Requirements for Pressure-Retaining Systems and Components in CANDU Nuclear Power Plants	1981	6.1
	Boiler and Pressure Vessel Regulations, Ontario Technical Standards and Safety Act	2000	6.2
N285.4	Periodic Inspection of CANDU Nuclear Power Plant Components	1994	6.3
S-296	Environmental Protection Policies, Programs and Procedures at Class I Nuclear Facilities and Uranium Mines and Mills	Current	7.5

Column 1	Column 2	Column 3	Column 4
Document Number	Title	Edition	Licence Condition
AECB-1049	Reporting Requirements for Fissionable and Fertile Substances	Current	8.15
S-99	Reporting Requirements for Operating Nuclear Power Plants	Current	10.7
	National Building Code of Canada	2005	11.1, 11.2
	National Fire Code of Canada	2005	11.1, 11.2, 11.3, 11.4
NFPA-801	Standard for Facilities Handling Radioactive Materials	2003	11.1, 11.2, 11.3, 11.4
CAN/CSA-N293	Fire Protection for CANDU Nuclear Power Plants	1995	11.2, 11.4
S-298	Nuclear Response Force Standard	Current	12.2
N286.0	Overall Quality Assurance Program Requirements for Nuclear Power Plants	1992	13.1
N286.1	Procurement Quality Assurance for Nuclear Power Plants	2000	13.1
N286.2	Design Quality Assurance for Nuclear Power Plants	2000	13.1
N286.3	Construction Quality Assurance for Nuclear Power Plants	1999	13.1
N286.4-M86	Commissioning Quality Assurance for Nuclear Power Plants	M1986	13.1
N286.5	Operations Quality Assurance for Nuclear Power Plants	1995	13.1
N286.6	Decommissioning Quality Assurance for Nuclear Power Plants	1998	13.1
N286.7	Quality Assurance for Analytical, Scientific and Design Computer Programs for Nuclear Power Plants	1999 (R2003)	13.1
ANSI/ANS-8.1	Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors	1998	14.2
ANSI/ANS-8.3	Criticality Accident Alarm System	1997 (R2002)	14.2
ANSI/ANS-8.5	Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material	1996 (R2002)	14.2
ANSI/ANS-8.6	Safety in Conducting Subcritical Neutron-Multiplication Measurements In Situ	1983 (R2001)	14.2
ANSI/ANS-8.7	Nuclear Criticality Safety in the Storage of Fissile Materials	1998	14.2

Column 1	Column 2	Column 3	Column 4
Document Number	Title	Edition	Licence Condition
ANSI/ANS-8.9	Nuclear Criticality Safety Criteria for Steel-Pipe Intersections Containing Aqueous Solutions of Fissile Materials	1987 (R1995)	14.2
ANSI/ANS-8.10	Criteria for Nuclear Criticality Safety Controls in Operations With Shielding and Confinement	1983 (R1999)	14.2
ANSI/ANS-8.12	Nuclear Criticality Control and Safety of Plutonium-Uranium Fuel Mixtures Outside Reactors	1987 (R2002)	14.2
ANSI/ANS-8.14	Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors	2004	14.2
ANSI/ANS-8.15	Nuclear Criticality Control of Special Actinide Elements	1981 (R1995)	14.2
ANSI/ANS-8.17	Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors	2004	14.2
ANSI/ANS-8.19	Administrative Practices for Nuclear Criticality Safety	1996	14.2
ANSI/ANS-8.20	Nuclear Criticality Safety Training	1991 (R1999)	14.2
ANSI/ANS-8.21	Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors	1995 (R2001)	14.2
ANSI/ANS-8.22	Nuclear Criticality Safety Based on Limiting and Controlling Moderators	1997	14.2
ANSI/ANS-8.23	Nuclear Criticality Accident Emergency Planning and Response	1997	14.2
GS-R-2, IAEA	Preparedness and Response for a Nuclear or Radiological Emergency, Safety Requirements	2002	14.2
H46-2/03-326E, Health Canada	Canadian Guidelines for Intervention during a Nuclear Emergency	2003	14.2

- 16.2 Amendment of the licence is not required prior to the licensee's implementation of a proposed change that has been approved pursuant to condition 16.1 of this licence. An approved change is deemed to be part of this licence.
- 16.3 In the event of any conflict or inconsistency between the requirements of the standards listed in the table and any requirement of the Commission pursuant to the *Nuclear Safety and Control Act* and its regulations, the licensee shall refer the matter to the Commission or a person authorized by the Commission for resolution.

17. SEALED SOURCE TRACKING

17.1 Unless otherwise permitted by the prior written approval of the Commission or a person authorized by the Commission, the licensee shall, in respect of a radioactive nuclear substance set out in column 1 of the table below, report in writing to the Commission any transfer, receipt, export or import of a sealed source whose corresponding activity is equal to or greater than the value set out in column 2 of the table:

- a) at least 7 days before any transfer or export, and
- b) within 48 hours of any receipt of a transfer or import.

Column 1	Column 2
Nuclear Substance	(TBq)
Americium 241	0.6
Americium 241/Beryllium	0.6
Californium 252	0.2
Curium 244	0.5
Cobalt 60	0.3
Cesium 137	1
Gadolinium 153	10
Iridium 192	0.8
Promethium 147	400
Plutonium 238	0.6
Plutonium 239/Beryllium	0.6
Radium 226	0.4
Selenium 75	2
Strontium 90 (Yttrium 90)	10
Thulium 170	200
Ytterbium 169	3

17.2 The written report shall be in a form acceptable to the Commission and shall include:

- 1) on transfer or export of a sealed source(s),
 - a) the date of transfer or export,
 - b) the export licence number (where applicable),
 - c) the name of the recipient and licence number, or
 - d) the name of the importer,
 - e) the address of the recipient's or importer's authorized location,
 - f) the nuclear substance (radionuclide),
 - g) activity (radioactivity) (Bq) per sealed source on the reference date,

- h) the reference date,
 - i) the number of sealed source(s),
 - j) the aggregate activity (Bq),
 - k) the sealed source unique identifiers (if available), and
 - l) where the sealed source is incorporated in prescribed equipment,
 - (i) the name and model number of the equipment, and
 - (ii) the equipment serial number (if available);
- 2) on receipt or import of a sealed source(s),
- a) the date of receipt of a transfer or import,
 - b) the name of the shipper and licence number, or
 - c) the name of the exporter,
 - d) the address of the shipper's or exporter's authorized location,
 - e) the nuclear substance (radionuclide),
 - f) activity (radioactivity) (Bq) per sealed source on the reference date,
 - g) the reference date,
 - h) the number of sealed source(s),
 - i) the aggregate activity (Bq),
 - j) the sealed source unique identifiers (if available), and
 - k) where the sealed source is incorporated in prescribed equipment,
 - (i) the name and model number of the equipment, and
 - (ii) the equipment serial number (if available).

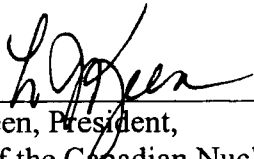
18. WASTE MANAGEMENT

- 18.1 The licensee shall produce, by October 31, 2007, a waste management framework document identifying the characteristics of all radioactive and hazardous wastes that are produced in the course of the current licensed activities or accepted from outside clients.
- 18.2 After December 31, 2007, the licensee shall not produce, in the course of the licensed activities, nor accept from outside clients, waste for which there is no identified and approved treatment, nor storage or disposal facility.
- 18.3 The licensee shall submit, by July 31, 2008, for approval by the Commission or a person authorized by the Commission a plan to dispose of, store or treat all wastes identified in conditions 18.1 and 18.2 of this licence.

19. NRU REACTOR OPERATION

- 19.1 The licensee shall comply with the requirements set out in the document entitled *Licensing Strategy for the NRU Licensability Extension Project*.

SIGNED at OTTAWA, this **31** day of July, 2006.



Linda J. Keen, President,
on behalf of the Canadian Nuclear Safety Commission

APPENDIX A

DOCUMENTS PERTAINING TO OVERALL OPERATION

Unless otherwise indicated, any change to any of the documents listed below requires the prior approval of the Commission or a person authorized by the Commission.

- 1) *Information in Support of Site Licence Renewal for Chalk River Laboratories*, AECL Document No. CRL-00521-LP-001, Revision 0, 2005 December.
- 2) *AECL's Radiation Protection Requirements*, AECL Document No. RC-2000-633-0, Revision 2, 2000 October.
- 3) *Chalk River Laboratories Site Emergency Plan*, AECL Document No. CRL-508000-PLA-001, Revision 0, 2003 October, and Addendum #1 to Revision 0, 2004 March.
- 4) *Derived Release Limits for Airborne and Liquid Effluents from Chalk River Laboratories During Normal Operations*, AECL Document No. RC-1731, Addendum 1, Revision 0, 1998 November.
- 5) *Chalk River Laboratories, Site Security Report*, AECL Document No. EPS-14000-RPT-17, Revision 10, April 2005.
- 6) *Code Classification and Design Registration of Pressure Retaining Systems and Components*, AECL Procedure No. 120-541.3, Revision 3, 2004 May.
- 7) Letter, R.P. Lambert of AECL to W.G. Martin of CNSC, *Action Levels*, AECL Document No. SERP 02-053, 2002 March 19.
- 8) *AECL Management Manual*, AECL Document No. CW-514000-MAN-002, Revision 1, 2005 April.
- 9) *Nuclear Laboratories, Nuclear Operations Quality Assurance Manual*, AECL Document No. 145-01913-QAM-001, Revision 1, 2005 August.
- 10) *Senior Reactor Shift Engineer Roles and Responsibilities Document*, AECL Document No. NRU-51000-REQ-001, Revision 0, June 2006.
- 11) *NRU Health Physicist Roles and Responsibilities*, AECL Document No. NRU-510000-REQ-02, Revision 0, June 2006.
- 12) *Comprehensive Preliminary Decommissioning Plan for AECL's Chalk River Laboratories*, AECL Document No. CPDP-01600-PDP-002, Revision 0, March 2005.

APPENDIX B

OPERATING FACILITIES

Unless otherwise indicated, any change to any of the documents listed below requires the prior approval of the Commission or a person authorized by the Commission.

Column 1 Facility	Column 2 Applicable document number and date of issue or revision
NRU Reactor	AECL-FA-01, Rev. 4, August 2000
Nuclear Fuel Fabrication Building 429A & 429B Facility	AECL-FA-02, Rev. 3, September 1998
Recycle Fuel Fabrication Laboratories	AECL-FA-03, Rev. 2, September 1998
Heavy-Water Upgrading Plant	AECL-FA-04, Rev. 3, September 1998
ZED-2 Reactor	AECL-FA-05, Rev. 7, March 2005
Building 234 Universal Cells	AECL-FA-06, Rev. 2, September 1998
Molybdenum-99 Production Facility	AECL-FA-07, Rev. 9, May 2004
Health Physics Neutron Generator	AECL-FA-14, Rev. 2, August 1998
Tritium Laboratory	AECL-FA-15, Rev. 1, May 1999
Waste Treatment Centre and Associated Facilities	AECL-FA-16, Rev. 5, November 1999
Fuels and Materials Cells	AECL-FA-17, Rev. 2, September 1998
Waste Management Areas	AECL-FA-18, Rev. 4, October 2001
Nuclear Fuel Fabrication Facility Building 405	AECL-FA-19, Rev. 3, September 1998
CECEUD Test Facility	AECL-FA-20, Rev. 5, December 2000

APPENDIX C

OPERATING FACILITIES IN A STORAGE-WITH-SURVEILLANCE STATE

Unless otherwise indicated, any change to any of the documents listed below requires the prior approval of the Commission or a person authorized by the Commission.

Column 1 Facility	Column 2 Applicable Document(s)
NRX Reactor	AECL Document No. NRX-06190-PLN-002, Rev. R3, <i>NRX Reactor Facility Storage With Surveillance Plan</i> , 2005 February.
NRX Fuel Bays	AECL Document No. NRX-06190-PLN-002, Rev. R3, <i>NRX Reactor Facility Storage With Surveillance Plan</i> , 2005 February.
Pool Test Reactor	AECL Document No. PTR-00422-6190-100, <i>Pool Test Reactor Phase 1 Decommissioning Monitoring, Testing and Surveillance Program</i> , 1998 July.
Plutonium Recovery Laboratory	AECL Document No. B220-06190-PLN-001, Rev. R1, <i>Plutonium Recovery Laboratory (Building 220) Storage With Surveillance Plan</i> , 2000 April.
Plutonium Tower	
Waste Water Evaporator	

APPENDIX D

CERTIFICATION REQUIREMENTS FOR NEW SENIOR REACTOR SHIFT ENGINEERS AT THE NRU REACTOR

1.0 QUALIFICATION REQUIREMENTS

A Senior Reactor Shift Engineer shall, at the time of certification at the NRU Reactor, meet the requirements specified in Subsections 1.1 to 1.3 of this appendix.

1.1 Education

Baccalaureate in engineering or science from a recognized university, or academic qualifications that meet the requirements for registration as a professional engineer in a province of Canada.

1.2 Experience

Minimum of four years of experience at a reactor facility, with at least two years of this experience as a shift supervisor at the NRU Reactor, prior to beginning the training relevant to the Senior Reactor Shift Engineer position.

1.3 Training

As specified in Section 2.0 of this appendix.

2.0 INITIAL TRAINING REQUIREMENTS

A Senior Reactor Shift Engineer shall meet the requirements specified in Subsections 2.1 to 2.6 of this appendix.

2.1 General Training

Have completed training, appropriate to the knowledge requirements of the position, covering:

- 1) science fundamentals relevant to the operation of the NRU Reactor;
- 2) principles of operation of the equipment and systems of the NRU Reactor; and
- 3) safety culture.

This training shall be followed by a comprehensive written examination set by the licensee that confirms and documents that, at the completion of the training, the person has the required knowledge to perform the duties of the Senior Reactor Shift Engineer.

2.2 Radiation Protection Training

Have completed training, appropriate to the knowledge requirements of the position, covering:

- 1) radiation fundamentals;
- 2) radiation hazards at the NRU Reactor;
- 3) biological effects of radiation;
- 4) radiation protection theory and practices; and
- 5) radiation protection procedures used during normal, abnormal, and emergency operation of the NRU Reactor.

This training shall be followed by a comprehensive written examination set by the licensee that confirms and documents that, at the completion of the training, the person has the required knowledge to perform the duties of the Senior Reactor Shift Engineer.

2.3 NRU-Specific Training

Have completed training, appropriate to the knowledge requirements of the position, covering:

- 1) design of the systems of the NRU Reactor, including:
 - a) design features and limitations of NRU Reactor equipment and systems, and
 - b) design requirements of safety-related equipment and systems;
- 2) operation of the equipment and systems of the NRU Reactor;
- 3) integrated operation of the systems of the NRU Reactor;
- 4) principles of nuclear safety and their application at the NRU Reactor;
- 5) reactor physics, principles of reactor operation and approach to criticality;
- 6) phenomena that may significantly affect core reactivity and reactivity management;
- 7) fuel characteristics, properties of irradiated fuel, factors influencing fuel temperature, irradiated fuel cooling, and physics of fuel failures;
- 8) fuelling strategies, operating constraints and limits associated with reactor fuelling, and consequences of fuelling errors;
- 9) fuel handling, fuel storage and nuclear criticality safety;
- 10) primary and back-up heat sinks;

- 11) chemical control of systems;
- 12) diagnosis of equipment failures and assessment of abnormal and emergency conditions at the NRU Reactor;
- 13) expected response of reactor systems to equipment failures and abnormal conditions;
- 14) operating strategies;
- 15) conventional and radiation hazards to NRU Reactor personnel and to the public, including radiological hazards from postulated accident conditions;
- 16) radiation dose control;
- 17) handling of conventional and radiation emergencies;
- 18) reactor safety analyses, including major assumptions in the accident analyses for the NRU Reactor, and technical bases for emergency operating procedures;
- 19) configuration of systems and equipment isolation required for maintenance activities;
- 20) administrative procedures related to the operation and maintenance of the NRU Reactor;
- 21) administrative procedures related to security of and access control to the NRU Reactor;
- 22) operating licence applicable to the NRU Reactor and documents referenced in the licence;
- 23) situations that may result in the violation of conditions in the operating licence applicable to the NRU Reactor and of the Limiting Conditions of Operation;
- 24) policies, standards and administrative procedures of the NRU Reactor and of the licensee;
- 25) requirements pertaining to operation of the NRU Reactor in *Federal and Provincial Acts* and regulations and in relevant standards and codes;
- 26) responsibilities and authority of the Senior Reactor Shift Engineer and of other NRU Reactor personnel who report to or interface with the Senior Reactor Shift Engineer;
- 27) qualification requirements of operating personnel who report to the Senior Reactor Shift Engineer;
- 28) emergency response procedures, including procedures for non-routine and emergency operating activities; and
- 29) measures and requirements pertaining to environmental protection.

This training shall be followed by a comprehensive written examination set by the licensee that confirms and documents that, at the completion of the training, the person has the required knowledge to perform the duties of the Senior Reactor Shift Engineer.

2.4 On-the-job Training

Have completed on-the-job training, appropriate to the knowledge and skill requirements of the position, covering:

- 1) operation and monitoring of equipment and systems of the NRU Reactor by the nuclear operators and by the shift supervisors, under normal, abnormal and emergency conditions;
- 2) standard operating practices;
- 3) monitoring of equipment and systems of the NRU Reactor by the Senior Reactor Shift Engineer, under normal, abnormal and emergency conditions;
- 4) diagnosis and decision making by the Senior Reactor Shift Engineer;
- 5) supervision and direction of operations in the control room, in the emergency control room and in the field at the NRU Reactor; and
- 6) authorization of maintenance and repair of NRU Reactor equipment and systems.

This training shall include performance evaluations that confirm and document that, at the completion of the training, the person has the required knowledge and skills to perform the duties of the Senior Reactor Shift Engineer.

2.5 Performing Duties under Supervision

Have performed the duties of a Senior Reactor Shift Engineer under the supervision of a certified incumbent of the position for a minimum of 150 hours on day shift after the person has met the requirements specified in Subsections 2.1 to 2.4 of this appendix.

2.6 Interview by NRU Reactor Management

Have completed an interview by NRU Reactor management that confirms and documents the person's competence to perform the duties of the Senior Reactor Shift Engineer. The person must complete this interview after having met the requirements specified in Subsection 2.5 of this appendix and before having completed the Commission examination specified in Section 3.0 of this appendix.

3.0 COMMISSION EXAMINATION FOR INITIAL CERTIFICATION

A Senior Reactor Shift Engineer shall, at the time of certification at the NRU Reactor, have successfully completed an examination administered by Commission staff that samples the topics specified in Subsections 2.1 to 2.3 of this appendix.

APPENDIX E

CERTIFICATION REQUIREMENTS FOR NEW NRU HEALTH PHYSICISTS

1.0 QUALIFICATION REQUIREMENTS

An NRU Health Physicist shall, at the time of certification, meet the requirements specified in Subsections 1.1 to 1.3 of this appendix.

1.1 Education

- a) Degree in health physics or Baccalaureate in engineering or science from a recognized university, with additional specialized courses on current radiation protection principles, methods and practices related to the operation of a nuclear reactor; and
- b) Successful completion of AECL's Group 1 Health Physicist Training Program.

1.2 Experience

Minimum of four years of experience in radiation protection in a nuclear facility. At least two years of this experience must be at CRL, of which at least six months (accumulated) experience must be in the NRU Reactor.

1.3 Training

As specified in Section 2.0 of this appendix.

2.0 INITIAL TRAINING REQUIREMENTS

An NRU Health Physicist shall meet the requirements specified in Subsections 2.1 and 2.2 of this appendix.

2.1 Knowledge Requirements

Have successfully completed training, appropriate to the knowledge requirements of the position, covering:

- 1) the relevant provisions of the *Nuclear Safety and Control Act* (the Act);
- 2) the regulations made pursuant to the Act and, specifically, the
 - a) *General Nuclear Safety and Control Regulations*,
 - b) *Radiation Protection Regulations*,
 - c) *Class I Nuclear Facilities Regulations*,
 - d) *Nuclear Substances and Radiation Devices Regulations*, and
 - e) *Packaging and Transport of Nuclear Substances Regulations*;
- 3) safety culture;
- 4) the responsibilities and authority of an NRU Health Physicist;
- 5) the responsibilities and authority of persons who interact with the NRU Health Physicist;
- 6) the operating licence for the CRL site and applicable to the NRU Reactor, including documents referenced in the licence;
- 7) the licensee's health and safety policy, radiation protection program requirements and associated standards and procedures; and
- 8) the design, operation and maintenance of the NRU Reactor to the degree required to fulfill the duties of the NRU Health Physicist.

2.2 Interview Administered by Licensee Management

Have completed an interview administered by the CRL radiation protection management that confirms and documents the person's competence to perform the duties of an NRU Health Physicist. The person must complete this interview after having met the requirements specified in Subsection 2.1 of this appendix and before taking the interview administered by Commission staff specified in Section 3.0 of this appendix.

3.0 COMMISSION EXAMINATION FOR INITIAL CERTIFICATION

An NRU Health Physicist shall, at the time of certification, have successfully completed an interview administered by Commission staff that samples the topics specified in Subsection 2.1 of this appendix and current radiation protection principles, methods and practices related to the operation of a research reactor.

APPENDIX F

REQUIREMENTS FOR CONTINUING TRAINING AND REQUALIFICATION TESTS FOR NRU SENIOR REACTOR SHIFT ENGINEERS AND NRU HEALTH PHYSICISTS

1.0 CONTINUING TRAINING REQUIREMENTS

1.1 Senior Reactor Shift Engineers

During the term of their certification, Senior Reactor Shift Engineers shall meet the requirements specified in Subsections 1.1.1 to 1.1.3 of this appendix.

1.1.1 Refresher Training

Participate, on a regular basis, in continuing training, appropriate to the knowledge and skill requirements of their position, covering:

- 1) a review of the knowledge learned during initial training that is not maintained through the day-to-day operation of the NRU Reactor and that is required to work competently in their position;
- 2) training exercises that cover infrequent yet normal NRU Reactor operations;
- 3) training exercises that cover a sufficiently varied number of situations that challenge their diagnostic and decision-making abilities and ensure that they are, at all times, proficient in selecting and using abnormal and emergency operating procedures; and
- 4) exercises and drills conducted at the NRU Reactor on a regular basis to practice the response to accidents and emergencies.

1.1.2 Update Training

Participate, in a timely manner, in training appropriate to the knowledge and skill requirements of their position and covering topics identified as a result of:

- 1) changes to equipment and systems of the NRU Reactor;
- 2) changes to policies, standards and procedures of the NRU Reactor and of the licensee;
- 3) changes to regulatory requirements;
- 4) changes to the operating licence applicable to the NRU Reactor or to documents referenced in the licence; and
- 5) experience and operating events at the NRU Reactor or in the industry.

1.1.3 Evaluations

Complete, on a regular basis, knowledge and performance evaluations that confirm and document that the person possesses the knowledge and the skills covered during continuing training.

1.2 NRU Health Physicists

A certified NRU Health Physicist shall complete, in a timely manner, training appropriate to the knowledge requirements of the position, covering:

- 1) changes to equipment and systems of the NRU Reactor;
- 2) changes to policies, standards and procedures of the NRU Reactor and of the licensee;
- 3) changes to regulatory requirements;
- 4) changes to the operating licence applicable to the NRU Reactor or to documents referenced in the licence; and
- 5) experience and operating events at the NRU Reactor or in the industry.

2.0 REQUALIFICATION TESTS

2.1 Senior Reactor Shift Engineers

Senior Reactor Shift Engineers seeking renewal of certification shall, within six months prior to the expiry date of their certification, have successfully completed a written requalification test designed and conducted by the licensee that samples the topics specified in Subsections 2.1, 2.2 and 2.3 of Appendix D to this licence and Subsections 1.1.1 and 1.1.2 of Appendix F to this licence that confirms that they have the knowledge required to work competently in their position.

2.2 NRU Health Physicists

NRU Health Physicists seeking renewal of certification shall, within six months prior to the expiry date of their certification, have successfully completed an interview conducted by Commission staff that samples the topics specified in Subsection 2.1 of Appendix E to this licence and Subsection 1.2 of Appendix F to this licence that confirms that they have the knowledge required to work competently in their position.