



Canadian Nuclear  
Safety Commission

Commission canadienne  
de sûreté nucléaire

# Record of Proceedings, Including Reasons for Decision

In the Matter of

Applicant Atomic Energy of Canada Limited

Subject Application to Renew its Nuclear Research and  
Test Establishment Operating Licence for the  
Chalk River Laboratories

Public Hearing  
Dates June 8 and October 4, 2011

**RECORD OF PROCEEDINGS**

Applicant: Atomic Energy of Canada Limited, (AECL)

Address/Location: 2251 Speakman Drive, Mississauga, Ontario, L5K 1B2

Purpose: Application to Renew its Nuclear Research and Test Establishment Operating Licence for the Chalk River Laboratories

Application received: September 30, 2010

Dates of public hearing: June 8 (Day 1) and October 4 (Day 2), 2011

Location: Canadian Nuclear Safety Commission (CNSC) Public Hearing Room, 280 Slater St., 14th. Floor, Ottawa, Ontario (Day 1) and Chalk River & Area Lions Club Hall, 11 Kellett Street, Chalk River, Ontario (Day 2)

Members present: M. Binder, Chair                      A. Harvey  
M. J. McDill                                      R. J. Barriault  
D.D. Tolgyesi

Secretary: M.A. Leblanc  
Recording Secretary: S. Dimitrijevic  
General Counsel: L. Thiele

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<b>Intervenors</b>		<b>Document Number</b>
See appendix A		

**Licence:** Renewed

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## INTRODUCTION

1. Atomic Energy of Canada Limited (AECL) has applied to the Canadian Nuclear Safety Commission<sup>1</sup> for the renewal of the Class I Nuclear Research and Test Establishment Operating Licence for its Chalk River Laboratories (CRL) located in Chalk River, Ontario. The current operating licence, NRTEOL-01.09/2011, expired on October 31, 2011. A Summary Record of Proceedings was issued on October 27, 2011, stating the Commission's decision to renew the operating licence for the CRL. AECL has applied for the renewal of this licence for a period of five years. In its application, AECL requested that the Dedicated Isotope Facilities (DIF) be included in the overall CRL site licence. The DIF currently operates under a separate operating licence, NPROL-62.04/2011, which was set to expire on October 31, 2011, coinciding with the expiration of the current operating licence for the CRL site NRTEOL-01.08/2011.
2. The CRL site comprises several nuclear facilities, including two operational nuclear reactors, the National Research Universal (NRU) and Z2 reactor. These facilities provide for the production of medical isotopes, the delivery of various nuclear services and the conduct of a wide variety of research and development programs. The built-up area of the site is occupied by 159 buildings that provide working space for approximately 3 000 employees. Outside the built-up area, there are several waste management areas for handling and storage of both nuclear and non-nuclear waste. The remaining operational life of the site is assumed, for planning purposes, to be approximately 100 years, although some facilities will undergo decommissioning during that time.

### Issue

3. In considering the application, the Commission was required to decide, pursuant to subsection 24(4) of the *Nuclear Safety and Control Act*<sup>2</sup> (NSCA):
  1. if AECL is qualified to carry on the activities that the licence would authorize; and
  2. if, in carrying on those activities, AECL would make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

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<sup>1</sup> The *Canadian Nuclear Safety Commission* is referred to as the "CNSC" when referring to the organization and its staff in general, and as the "Commission" when referring to the tribunal component.

<sup>2</sup> Statutes of Canada (S.C.) 1997, c. 9.

### Public Hearing

4. The Commission, in making its decision, considered information presented for a public hearing held on June 8, 2011 in Ottawa, Ontario (Day 1) and on October 4, 2011 in Chalk River, Ontario (Day 2). The public hearing was conducted in accordance with the *Canadian Nuclear Safety Commission Rules of Procedure*<sup>3</sup>. During the public hearing, the Commission considered written submissions and heard oral presentations from CNSC staff (CMD 11-H7, CMD 11-H7.A, CMD 11-H7.B, CMD 11-H7.C, and CMD 11-H7.D) and AECL (CMD 11-H7.1, CMD 11-H7.1A, CMD 11-H7.1B, CMD 11-H7.1C, CMD 11-H7.1D, CMD 11-H7.1E, CMD 11-H7.1F and CMD 11-H7.1G). Following the Commission's invitation to participate in the public hearing process, Emergency Management Ontario (EMO) updated the Commission on its activities related to emergency preparedness of the communities surrounding the CRL site and on coordination of these activities at the municipal and provincial levels (CMD 11-H7.2 and CMD 11-H7.2A). The Commission also considered oral and written submissions from 16 intervenors (see Appendix A for a detailed list of interventions).

### **DECISION**

5. Based on its consideration of the matter, the Commission concludes that AECL is qualified to carry on the activity that the licence will authorize. The Commission is of the opinion that AECL, in carrying on these activities, will make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed. Therefore,

the Commission, pursuant to section 24 of the *Nuclear Safety and Control Act*, renews the Nuclear Research and Test Establishment Operating Licence issued to Atomic Energy of Canada Limited for its Chalk River Laboratories. The renewed licence, NRTEOL 01.00/2016, is valid from November 1, 2011 to October 31, 2016.

6. The Commission includes in the licence the conditions as recommended by CNSC staff and set out in the draft licence attached to CMD 11-H7.D.
7. The Commission includes the authorization of activities related to the Dedicated Isotope Facility into the renewed operating licence for the CRL site.

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<sup>3</sup> S.O.R./2000-211.

8. The Commission determined that there was no requirement for an Environmental Assessment pursuant to subsection 5(1) of the *Canadian Environmental Assessment Act*<sup>4</sup> (CEAA). The Commission is satisfied that all applicable requirements of the CEAA have been fulfilled.
9. With this decision, the Commission requests that AECL prepare yearly reports on compliance monitoring and operational performance. In addition, with respect to the operation of the National Research Universal reactor, the Commission expects to receive AECL's report on progress made regarding the reactor vessel inspection by the end of February 2012.
10. The Commission directs CNSC staff to adjust the proposed *Licence Conditions Handbook* (LCH), set out in the CMD 11-H7.B, so that it reflects the Commission's decision.

### **ISSUES AND COMMISSION FINDINGS**

11. In making its licensing decision, the Commission considered a number of issues relating to AECL's qualification to carry out the proposed activities and the adequacy of the proposed measures for protecting the environment, the health and safety of persons, national security and international obligations to which Canada has agreed.
12. AECL representatives informed the Commission on operations at CRL during the current licence period with particular reference to the NRU reactor, general items of regulatory interest, implemented improvement initiatives, and public communication. CNSC staff presented their assessment of the application, ratings of all Safety and Control Areas (SCA) and recommendations.

### **Management System**

13. The specific areas of this SCA include:
  - organizational structure;
  - organizational change management;
  - management system and quality assurance;
  - monitoring and review of safety performance; and
  - safety culture.

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<sup>4</sup> S.C. 1992, c. 37.

14. AECL informed the Commission about organizational changes that the CRL have undergone since the 2006 licence renewal, including AECL's restructuring caused by the Government of Canada's plans to split the commercial side of the company (CANDU business) from the operation of the main nuclear laboratories. They stated that the ownership, policy mandate and funding of the nuclear laboratories will continue to rest with the Government of Canada; however, the restructuring may impact site operations as some policies, processes and procedures may need to be updated. AECL representatives added that the Government of Canada was evaluating the management model for the CRL site.
15. CNSC staff reported that they have rated this safety area as below expectations, based on long-standing deficiencies with the implementation of the quality assurance programs for the facilities at the CRL site and required improvements to organization and safety culture. They said that the current rating was showing an improving trend, and added that, since 2008, AECL has made progress in realigning towards an Integrated Management System.
16. CNSC staff informed the Commission that, based on the lessons learned from the extended shutdown of the NRU Reactor in late 2007 and corrective actions from the Talisman report, CNSC staff have clarified requirements and expectations with respect to organizational change management, quality assurance and safety culture. In order to ensure progress in this area, CNSC staff had requested that AECL develop a detailed improvement plan. In response, the corrective action plan covering a broad range of activities from new policies to the development of a human performance program and implementation of best industry practices (known as Voyager Phase II program) had been developed and launched in 2010. AECL forecast the completion of the program in March 2014. After the first update by AECL and follow-up inspections in 2011, CNSC staff is of the opinion that the implementation of the Voyager program is on schedule and is acceptable.
17. With respect to the restructuring and organizational changes, CNSC staff informed the Commission that the major reorganization of AECL's operation group at the CRL site had become effective on April 1, 2011 and that they were assessing this organizational change. They added that they would continue to apply enhanced oversight to the CRL's organization as AECL's restructuring unfolds, noting that they had not detected any negative impact on AECL's overall safety performance as a result of these changes.
18. During Day 2 of the Public Hearing, AECL representatives informed the Commission that, in the meantime, the Government of Canada had announced the sale of AECL's CANDU reactor division, and that AECL will remain a Crown Corporation, comprising nuclear laboratories, as a lone nuclear science and technology organization. AECL representatives added that, in preparation to become a stand-alone corporation, all organizational, financial and legal functions have been relocated to Chalk River, and that these changes have resulted in the appointment of three new vice-presidents and in the opening of 86 new positions in the laboratories. AECL representatives stated that these activities are being led by the Government of Canada through Natural Resources Canada.



19. CNSC staff stressed that AECL is transitioning to a new management system based on CSA standard N286-05 and stated that they recognise that full transition would take some time and that a gradual transition is appropriate in complex organizations with a safety focus. They added that AECL's transition approach was well documented and typical for the complete implementation of an integrated management approach in a complex nuclear organization.
20. The Commission noted that the same areas had the same rating, below expectations, for the last licence renewal evaluation in 2006, and asked how AECL plans to resolve these issues during the proposed licence period and how CNSC staff intend to ensure that these concerns are resolved on time and to their satisfaction. AECL representatives responded that AECL had made necessary changes to the management system and put in place a new management manual to demonstrate its intention to comply with the requirements of standards on quality management while meeting the needs of the Treasury Board management accountability framework. AECL representatives added that, with respect to their safety culture, the Voyager II program progresses well and added that they expect feedback from the staff through quarterly safety culture reviews to ensure that all issues are addressed as the program moves forward.
21. Asked to present their view regarding safety and control areas rated below expectations, CNSC staff responded that they have clearly defined the requirements and expectations in the proposed licence conditions and Licence Conditions Handbook (LCH), and noted that, according to their assessment, AECL was on track with the planned improvements. CNSC staff added that they have recommended that AECL prepare annual reports on the status and progress made in relevant areas.
22. Concerned Citizens of Renfrew County, in their intervention, suggested that nuclear workers and managers study past nuclear accidents at a range of facilities, as an important aspect of safety culture in the Canadian nuclear industry. AECL representatives stated that they were moving ahead with the Voyageur II program that outlines the actions and plans to improve general and specific aspects of their safety culture. CNSC staff noted that AECL has already taken necessary steps to improve their safety culture, based on the lessons learned from the NRU reactor vessel leak and other safety culture assessments.
23. The Commission asked for reasons why a full implementation of the Integrated Management System would be completed only in 2016. AECL representatives responded that a full integration of a complex system combined with reorganization requires sufficient transition time. CNSC staff stated that, based on the progress achieved so far, they expect that AECL would reach a "satisfactory" rating even before the implementation is completed.

### *Conclusion on Management System*

24. Based on its consideration of the presented information, the Commission concludes that AECL has appropriate organization and management structures in place to adequately carry out the activities under the proposed licence.

### **Human Performance Management**

25. The specific areas that comprise this SCA for the CRL site include:
  - training;
  - certification;
  - staffing; and
  - human performance.
26. AECL noted that progress has been made in the establishment of an integrated Human Performance Program through alignment of training on the fundamentals.
27. AECL reported providing training to all employees to ensure that appropriate job-specific knowledge and skills are achieved. AECL described the training initiatives taken since 2008 to improve the safe operation of the facilities. AECL noted the existence of a centralized learning management system and training database for the retention of training records for all employees to ensure employees are qualified to perform their duties.
28. CNSC staff reported that they have rated this safety area as satisfactory, and said that minor deficiencies identified during numerous reviews of the AECL's training programs had been addressed and resolved in a timely manner.
29. CNSC staff reported having reviewed the Return to Service Training Plan that AECL submitted for the NRU return to service and found it to be acceptable and compliant with AECL's Systematic Approach to Training (SAT). Past inspections have also showed the training programs at AECL to be in accordance with the principles of SAT and to meet licence conditions.
30. CNSC staff noted that a review of the shift performance duty for all Senior Reactor Shift Engineers and NRU Health Physicists throughout the current licence period confirms that they were in compliance with the minimum shift duty requirements.
31. CNSC staff determined that AECL has continued to meet the minimum staffing levels as assessed in the Safety Analysis Reports (SAR) and specified in the Facility Authorization (FA) documents for operating facilities at the CRL site.

32. CNSC staff further reported that the Voyager Phase II Program had identified several actions to improve human performance at the CRL site, and concluded that AECL has made progress in implementing elements of a human performance program for the CRL site.
33. AECL reported that there are several processes in place for determining fitness for duty, including the determination of minimum staffing requirements for the operating and support crew at the NRU Reactor, as well as the minimum operating crew for specific conditions related to loops and rods status. AECL also listed several programs in place to ensure the fitness for duty and well-being of workers at the site.
34. CNSC staff reported that they are in the process of completing a formal review of fitness for duty policies and programs currently in place at several major facilities in Canada, including the NRU Reactor. CNSC staff added that they are proposing the development of fitness for duty requirements based on the results of CNSC staff's review of licensees' documentation and benchmarking activities. CNSC staff plans to present these proposed requirements to the Commission by the end of the year 2011. The proposed requirements will then go through a consultation period. CNSC staff noted that AECL submitted fitness for duty requirement documentation specific to the NRU workers as part of the CNSC benchmarking activities.

#### *Conclusion on Human Performance Management*

35. Based on its consideration of the presented information, the Commission concludes that AECL has appropriate human performance programs in place, which shows AECL's ability to adequately carry out the activities under the proposed licence.

#### **Operating Performance**

36. The specific areas comprised in this SCA include:
  - facilities operating performance;
  - operating experience (OPEX); and
  - reporting.
37. AECL representatives informed the Commission about the initiatives and program improvements that would ensure continued safe operation of the facilities and laboratories. They stated that a continued safe operation of the NRU reactor for the next ten years would be supported by the timely execution of the NRU Integrated Implementation Plan.
38. AECL noted that, since the licence renewal in 2006, the facilities at CRL have operated reliably and in conformance with regulatory requirements. None of the events of regulatory significance resulted in any significant radiological exposure to a worker or a member of the public or significant release to the environment.

39. CNSC staff reported that they had reviewed the conduct of the activities that enable effective performance at the CRL site and rated this safety area as satisfactory.
40. CNSC staff reported that they observed that facilities at the CRL site are operated in compliance with the *NSCA*, its *Regulations* and the licence conditions. CNSC staff further noted that the inspections conducted during the current licence period did not result in any major findings, with the exception, in late 2007, of the Emergency Power Supply connection to Main Heavy Water Pumps which had not been completed.
41. CNSC staff explained that a number of actions arising from inspections remain open due to the long-term nature of the corrective actions. AECL has submitted periodic updates on their progress, and CNSC staff is satisfied with the actions taken by AECL.
42. AECL representatives further informed the Commission that their Operating Experience Program served as a learning mechanism to improve operational and safety performance. The program makes use of tracking tools and internal and external information databases to improve the safety of operations and operational performance, and reduce the significance and the occurrence of unplanned events.
43. CNSC staff reported having been monitoring the quality of the root cause analysis reports, and that these reports continue to show signs of weaknesses. CNSC staff noted having observed a number of efforts by AECL to improve their quality, and that the quality of root cause analyses has been improving over the licence period.
44. AECL stated that the reporting culture had improved significantly with the introduction of an improved electronic tool to facilitate reporting of problems and events (ImpAct process), providing transparency to low-level events. AECL noted that improvements in events reporting could also be attributed to the introduction of the Regulatory Standard S-99 into the CRL operating licence and subsequent clarification of reporting requirements.
45. CNSC staff agreed that the reporting culture has significantly improved during the licence period. Some issues noted regarding the lack of, or late, reporting, have led CNSC staff to add clarification in detailed compliance verification criteria for unplanned events in the proposed LCH.

#### *Conclusion on Operating Performance*

46. Based on its consideration of the presented information, the Commission concludes that the operating performance at the facility provides a positive indication of AECL's ability to adequately carry out the activities under the proposed licence, and to provide adequate protection to the health and safety of persons and the environment.

## **Safety Analysis**

47. In reviewing this Safety and Control Area (SCA), CNSC staff assessed the following specific areas:
- facility safety analysis reports and facility authorization documents;
  - nuclear criticality safety;
  - Firs Hazard Analysis; and
  - defence-in-depth and external events (Fukushima events).

### *Safety Analysis Reports*

48. AECL representatives informed the Commission that, since the licence renewal in 2006, AECL had reviewed all of the safety analysis reports for the Class I facilities at CRL. AECL has initiated revisions of safety analysis reports for all other operational facilities. In addition, AECL has initiated the development of a Conduct of Safety Engineering to provide an overall process for integrated safety analysis.
49. CNSC staff explained that, prior to the current licence period, AECL's approach to updating the safety cases for facilities at the CRL site had not been satisfactory. As a consequence, the current CRL site licence issued in 2006 included two conditions requiring AECL to develop, maintain and revise safety analysis reports (SAR) and facility authorizations (FA). CNSC staff confirmed that AECL had responded to these requirements and had initiated revisions of SARs and FAs. CNSC staff rated the current AECL's performance in this area as satisfactory.
50. AECL reported that the NRU Reactor safety case consists of several documents that have been progressively updated and released during the period 2007 March to today. CNSC staff reviewed the documents and concluded that the NRU safety case demonstrates no immediate risk arising from continued operation, but a number of key areas require further assessment to provide assurance of adequate safety in the long-term. AECL is required to address these issues in the longer term. These issues are part of the AECL Integrated Implementation Plan.
51. AECL noted that, in parallel with activities related to the NRU Reactor safety case, there has been significant work undertaken to subject the NRU to an Integrated Safety Review in accordance with CNSC Regulatory Document RD-360, *Life Extension of Nuclear Power Plants*. This work has resulted in the production of a long-term activity plan addressing a broad range of topics.

### *Nuclear Criticality Safety*

52. AECL reported that, during the current licence period, the Nuclear Criticality Safety program has completed all documentation for the implementation of the program, including procedures specific to training and operations. AECL noted a significant increase in the strength of criticality safety training since this program was established.

53. AECL reported that the revision of the first high-priority criticality safety document has been completed for the Nuclear Fuel Fabrication Facilities, and that a priority list for updating the criticality safety documents was developed.
54. CNSC staff confirmed that, in late 2008, AECL finalized the Nuclear Criticality Safety Program, as required by the current operating licence. CNSC staff considers the program acceptable, as well as its implementation, despite being slower than originally planned.

#### *Fire Hazard Analysis*

55. AECL reported that fire hazard assessments have been initiated site-wide, with fire hazard assessments being completed for all nuclear facilities and a risk-grade approach used to identify all associated facilities requiring fire hazard assessments due to proximity, support functions or shared services. CNSC staff noted that the completion status of the Fire Hazard Analyses is in accordance with an established completion plan that is acceptable to CNSC staff.
56. CNSC staff stated that an inspection conducted in September 2010 to verify progress on the Fire Hazard Analysis upgrades for the NRU reactor identified slippages in the implementation of the remedial actions. AECL is allocating more resources to correct this situation. AECL's recent updates indicate that AECL remains on target to implement all Fire Hazard Analysis recommendations prior to October 31, 2011. CNSC staff intends to monitor progress on these activities.
57. CNSC staff reported that AECL has presented a corrective action plan for the implementation of the fire upgrade recommendations stemming from the Fire Hazard Analyses, which is considered acceptable. CNSC staff is closely monitoring progress on these activities.
58. AECL explained that a corrective action plan for the implementation of CNSC staff's recommendations of the NRU Fire Hazard Analysis is developed, with progress updates provided to CNSC staff on a quarterly basis. AECL expressed its commitment to the implementation of Fire Hazard Analysis recommendations. CNSC staff reported that, for the NRU Reactor, AECL has completed a Fire Hazard Analysis and a Fire Safe Shutdown Analysis. However, the resulting recommendations for the safety upgrades were not addressed in a timely fashion<sup>5</sup>.

#### *Fukushima Events*

59. CNSC staff reported that, following the Fukushima events, they carried out inspections and on-site verifications of systems and components at CRL credited to either prevent or mitigate serious events. CNSC staff raised a number of follow-up actions as a result of these inspections. CNSC staff follow up on these issues and continue to monitor progress, but they have not identified immediate safety concerns with the continued operation of facilities at CRL.

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<sup>5</sup> CNSC staff confirmed after the hearing that they are still following-up on the issue and that targeted completion of the safety upgrades is currently March 2012.

60. CNSC staff further noted that AECL and CNSC staff reviewed the Integrated Implementation Plan in light of the initial lessons learned from the Japan events. This activity increased the priority of some verification activities related to severe accident management and seismic assessments.
61. CNSC staff reported that, following the letter pursuant to section 12(2) of the *General Nuclear Safety and Control Regulations*, issued on March 17, 2011, regarding the initial lessons learned from the events at the Fukushima Daiichi nuclear power plant in Japan, AECL undertook several short-term actions to address this request. AECL concluded that there are no safety issues requiring immediate action at CRL and that the risk related to ongoing operation of facilities remains low. AECL also identified a number of opportunities for improvement to strengthen hazard analyses. CNSC staff noted that additional information is required to support AECL's conclusions, and that they will review in detail AECL's findings and corrective actions to confirm their adequacy.
62. Concerned Citizens of Renfrew County, in their intervention, recommended that, in light of the Fukushima disaster, more planning and preparation be done to deal with the aftermath of even the most unlikely combination of failures at NRU, and insisted on lessons learned from the event. CNSC staff responded that a task force had already been put in place at the CNSC to review the lessons learned at Fukushima. CNSC staff will prepare an action plan from the lessons learned and feedback from the public and industry, which would be presented at the public proceedings of the Commission in February 2012. CNSC staff added that the closures to the short-term actions had been already addressed at the NRU site, and CNSC inspectors had verified these short-term actions.

#### *Conclusion on Safety Analysis*

63. On the basis of the information presented, the Commission concludes that the safety analysis, systematic evaluation of the potential hazards and the preparedness for reducing the effects of such hazards is adequate for the operation of the facility and the activities under the proposed licence. The Commission notes that some analyses and upgrades are still underway, and invites AECL to allocate resources to complete them as soon as practicable.

#### **Physical Design**

64. Within this safety and control area, the Commission evaluated the following specific areas:
  - engineering change control;
  - configuration management; and
  - pressure boundary program.

65. AECL representatives informed the Commission about their new organizational infrastructure and improved processes for Design, Engineering Change Control, Field Change Control, Item Equivalency Evaluations and Technical Operability Evaluations. These process improvements had been made based on benchmarking of Canadian nuclear utilities and the World Association of Nuclear Operators Performance Objectives and Criteria.
66. AECL reported having created the position of the Chief Nuclear Engineer that includes the role of the Design Authority for the Nuclear Laboratories. With respect to the Pressure Boundary program, the Chief Nuclear Engineer had been also appointed as the Program Authority, in order to ensure effective implementation of the program requirements within Nuclear Laboratories. To support the program, the Pressure Boundary program office had been established, as well as the cross-functional Pressure Boundary Working Group, which provides managerial oversight and ongoing assessment of all aspects of the program.
67. CNSC staff informed the Commission that they had inspected AECL's configuration change control processes and found minor deficiencies in its implementation. CNSC staff added that AECL had submitted an action plan to correct these deficiencies. Although the resolution of this action plan was delayed while AECL's resources supported high priority NRU Reactor Vessel Leak Repair activities, CNSC staff found it to be a significant improvement over the previous process. CNSC staff noted that improvements to the process were currently progressing well.
68. With respect to the pressure boundary program, CNSC staff noted that AECL has made numerous improvements, and that important inspections and repairs to many safety and support systems had been performed as part of the recent NRU Reactor vessel repair. AECL used procedures accepted and witnessed by an authorised inspection agency, the Technical Standard and Safety Authority (TSSA).
69. CNSC staff informed the Commission about observed deficiencies related to configuration management practices at the CRL site, and noted that they expect that the new Engineering Change Control (ECC) Process, along with recent configuration management initiatives, will strengthen the design configuration control over time. CNSC staff rated this SCA as satisfactory.
70. The Commission asked for comments regarding the statement in the submission from the Concerned Citizens of Renfrew County about the continued leakage of the NRU fuel bay and lack of containment structure. CNSC staff responded that containment is sought for in cases where there is a chance of pressurizing the building, which is more typical for power reactors. In the case of NRU reactor, which operates at atmospheric pressure, it is confinement that is important, so that the exchange of matter from the building to the environment is prevented. CNSC staff said that they already had recommended some analysis of various severe accident scenarios, not necessarily to see what the consequences are, but rather to understand how an accident could progress and learn how to mitigate it.



71. With respect to the leakage in the NRU fuel bay, AECL representatives responded that there was minor leakage, noticed in the 1960's that was continually monitored. Evaluation of monitoring results shows that the plume is primarily comprised of tritium, which proceeds towards the Ottawa River. These results are reported to the CNSC on a quarterly basis. AECL representatives added that there were no plans to replace the rod bay, as is; however, it is planned to replace the water from the bay with clean water. AECL had also taken steps to mitigate the tritium going into the rod bay by replacing the tritiated heavy water with clean water. Asked if this is an acceptable practice, CNSC staff responded that the Commission had addressed this issue before, and that AECL had been requested to minimize the leak. CNSC staff added that the most successful solution to date had been to reduce the amount of tritium leaking out of the bays, and that CNSC wants to make sure that if there is a leak, it should not add the tritium load into the water.

*Conclusion on Physical Design*

72. On the basis of the information presented, the Commission concludes that the ability of systems, components and structures to maintain their design basis is adequate for the operation period included in the proposed licence.

**Fitness for Service**

73. The Commission considered the following specific topics within this safety and control area:
- fitness for service of facilities' systems and components;
  - maintenance program and master equipment list (MEL);
  - ageing management; and
  - planned extended outages.
74. AECL representatives informed the Commission on the work performed to refurbish a number of the NRU structures, systems, and components, which had been done during the extensive activity program associated with the extended shutdown for vessel repair. AECL representatives stated that, although the NRU reactor is fit for service, it was recognized that ageing degradation of a number of the NRU safety-related structures, systems, and components, could result in issues that could affect the reliable operation of the NRU. They added that there were Ageing Management Plans for 26 NRU systems and that periodic and in-service inspection programs had been developed and implemented for a number of NRU systems, including experimental test loops and in-core test sections, the heavy water system, and the reactor vessel.
75. AECL representatives also informed the Commission that the Ageing Management Program had been prepared for the Z2 reactor and the implementation had begun for the Molybdenum-99 Production Facility. They added that Master Equipment Lists were being prepared for all nuclear facilities on the CRL site, and that the production of these lists was on target for completion by July 2013, in accordance with a risk-based prioritization.

76. CNSC staff reported that the Ageing Management Program was an area where they had observed long-standing weaknesses in both AECL's performance and programs. The ageing of infrastructure and weaknesses in maintenance and monitoring programs at Chalk River had resulted in a number of events that have been reported to the Commission over the last five years. CNSC staff noted that the compliance rating for this area was below expectations based on the degradation of some systems and components due to physical ageing, noted weaknesses in the maintenance program for the CRL site, and lack of progress on an ageing management program for the NRU Reactor.
77. Regarding actions taken on ageing management, CNSC staff also noted that, in 2008, AECL and the CNSC had signed a protocol to prepare the information needed for the Commission to assess the continued operation of the NRU beyond the current licence period. CNSC staff and AECL have implemented an Integrated Safety Review (ISR) of the facility to evaluate the overall acceptability of continued operation of the NRU Reactor to 2021. The ISR is created as an all-inclusive and systematic evaluation of plant design, condition and operation, including all aspects of the operating organization and programs, aiming at determining the extent to which the plant conforms to modern standards.
78. CNSC staff pointed out that the ISR is a key element in determining the work required for the long-term fitness for service and reliability of the NRU reactor. With the ISR Basis Document which specifies the scope and methodology for the conduct of ISR, the full report comprised the following documents:
  - Safety Factor Reports (SFRs) in which AECL assessed the current state of the facility against the requirements and expectations expressed in modern codes and standards;
  - Global Assessment Report (GAR) assesses the overall safety and reliability of the NRU reactor and ranks the ISR results based on their safety and operation significance; and
  - Integrated Implementation Plan (IIP) that integrates all the ISR results into an implementation plan.
79. CNSC staff added that they had extensively and thoroughly assessed the AECL's ISR documents, performed onsite assessments of the actual condition of three NRU reactor structures, systems and components (SSCs) and conducted an internal workshop to peer-review the preliminary results of their assessment. CNSC staff also added that they had found the IIP acceptable after a number of clarifications provided by AECL, and stated that the key issue for CNSC had been to ensure that the plan provides for concrete and measurable actions to address findings from the safety review.
80. With respect to the licence conditions related to the ISR, CNSC staff recommended the inclusion of a licence condition requiring the licensee to progress to completion of the improvements identified during the NRU reactor Integrated Safety Review. CNSC staff also recommended that AECL submit annual reports to the Commission on the status of the improvements identified by the Integrated Safety Review.

81. CNSC staff further recommended that AECL develop and submit for the approval of the Commission, by June 30, 2014, a plan for the end of operation or for continued operation of the NRU reactor beyond 2016. This plan submitted by the proposed date would ensure that there is a defined approach for the future of the NRU before the expiry of the proposed licence.
82. With respect to the ageing installations, CNSC staff informed the Commission that AECL had taken appropriate actions to mitigate the deficiencies observed in the NRU reactor, with the fissile solution storage tank (FISST), and with the storage tank and transfer lines associated with the waste treatment centre.
83. Asked to provide more details on the current fitness for service of the facility and status of the NRU vessel, CNSC staff explained that there had been improvements in control and monitoring of radioactive liquid waste storage and noted that AECL has taken appropriate steps on the individual leaks, but better programs were required to prevent future leaks. As a condition of the Commission's approval to restart the reactor in July 2010, AECL was required to undergo a planned extended shutdown to inspect the vessel within nine months of the reactor restart. CNSC staff reported that AECL had encountered challenges and was not able to complete all the planned inspections. CNSC staff's position was that complete inspections of all weld-repaired areas are required to provide a baseline for future inspections and to ensure the ongoing fitness for service of the NRU vessel. CNSC staff therefore recommended that the Commission request an update on the completion of the NRU vessel inspection by February 2012.
84. Noting the public interest in AECL's ability to keep up with the commitments regarding the NRU reactor operation, the Commission inquired on remaining tasks and projected time-line for completing all planned activities. AECL representatives responded that AECL plans to complete inspections of the welds along the lower heat-affected zones of the reactor by January 2012 during regular outages, and other locations during the extended outage planned for April 2012. AECL representatives added that they had used alternative techniques to collect data to demonstrate that the reactor vessel was fit for service and that there were no changes to the repaired surfaces within the accuracy of the inspection techniques. Asked to comment, CNSC staff stated that they were satisfied with the inspection results and that they had no safety concerns.
85. In their submissions, the Lantheus Medical Imaging, Inc. (Lantheus), Best Theratronics and the Cancer Centre of Southeastern Ontario (CCSEO) Medical Physics Department stressed the importance of the isotope production for the use in different fields of medicine, and supported renewal of the operating licence for the CRL facilities and continuous operation of the NRU reactor. The Commission inquired about potential impact of outages related to the operation of the NRU reactor. Lantheus representatives responded that they were working actively to be able to supply the market, expecting that the NRU Reactor would not produce during outages, and noted that the longer the outage, the more difficult it is to coordinate supply through a global network. They noted that, due to the extended pause in production of isotopes during the NRU Reactor

outage and the consequent shortage of medical isotopes worldwide, the nuclear medicine market had decreased to some degree because of increased efficiencies in isotope use and moves to other modalities.

86. The Commission asked for potential consequences of a planned end of the isotope production by 2016. Lantheus representatives responded that they were looking for a solution through ongoing projects in the USA and Europe, and stressed the importance of domestic production of isotopes for medical application, particularly for short-lived isotopes.
87. Concerned Citizens of Renfrew County, in their intervention, recommended that the NRU reactor vessel be completely replaced. The Commission, taking note that this issue had been addressed in details in the past, asked CNSC staff and AECL for comments. AECL representatives noted that the timelines associated with replacing the vessel would probably be in the order of four years, while the reparation had been done in a significantly shorter time. CNSC staff emphasized that, from a safety perspective, the vessel, having been repaired, had been found to be fit for duty. The Commission concluded this discussion remarking that the decision on whether to replace the vessel or to repair it had been a policy decision of the government.

#### *Conclusion on Equipment Fitness for Service*

88. The Commission is satisfied with AECL's programs for the inspection and life-cycle management of key safety systems. Based on the above information, the Commission concludes that the equipment as installed and maintained at the CRL site is fit for service.

#### **Radiation Protection**

89. AECL representatives presented to the Commission dosimetry data representing annual radiation exposure of their workers, showing that the doses were well below the regulatory limits.
90. CNSC staff confirmed AECL's dosimetry data and stated that effective doses to workers and members of the public were well below regulatory limits. CNSC staff also noted that there were radiation exposure action level exceedances to three workers during the current licensing period. In each case, AECL conducted an event investigation and developed corrective action plans. CNSC staff is satisfied with these plans and the actions taken by AECL to prevent recurrence.
91. AECL noted that a significant quantity of new radiation protection equipment was procured, installed and commissioned during the current licensing period, leading to further improvements in the area of contamination control at the Chalk River Laboratories.

92. CNSC staff reported having conducted several facility-specific compliance inspections focused on radiation protection to assess the effectiveness of the licensee's programs. Findings from these inspections have been addressed to CNSC staff's satisfaction. CNSC staff also reported having conducted six audits on AECL's radiation protection program during the current licence period. In each case, CNSC staff concluded that, while the program and its implementation were adequate, improvements were necessary in a number of areas. AECL has closed most of the action items resulting from these audits to CNSC staff's satisfaction. However, a number of actions remain open due to longer-term corrective action plans. AECL submits periodic status reports to the CNSC on their completion progress. CNSC staff considers the corrective action plans to be appropriate.
93. AECL reported that, in response to CNSC staff's letter pursuant to section 12(2) of the *General Nuclear Safety and Control Regulations* following findings about exposure of workers to alpha contamination at the Bruce Nuclear Power Plant, AECL has initiated a review of its management and control of alpha emitting radiological contamination. AECL noted that, while the AECL radiation protection program includes requirements to identify the magnitude of the contamination of hazards in the workplace (including alpha radiation), AECL decided to implement a plan for undertaking a reference hazard analysis at the Chalk River Laboratories. The final report is planned to be available by the end of 2011. CNSC staff confirmed that AECL was requested to review the appropriateness of its alpha monitoring program, and that the work is ongoing. CNSC staff stated that AECL's radiation protection program and dosimetry service have provisions in place to address alpha radiation hazards in the workplace.
94. AECL reported that, during the current licence period, two internal audits on the implementation of the Radiation Protection Program were carried out. Corrective action plans resulting from these audits were developed and implemented, with one item remaining.
95. CNSC staff informed the Commission that their assessment of this safety and control area showed that AECL has a well-developed and satisfactory radiation protection program.

*Conclusion on Radiation Protection*

96. The Commission is of the opinion that, given the mitigation measures and radiation protection programs that are in place or will be in place to control hazards, AECL will provide adequate radiation protection to the health and safety of persons and the environment.

### **Conventional Health and Safety**

97. AECL informed the Commission on the current programs and measures to protect workers from different physical, chemical and biological hazards that the workers may be exposed to. AECL noted that the Occupational Safety and Health department was reorganized in 2008 to increase Occupational Safety and Health oversight at the CRL site. AECL representatives presented to the Commission data on the frequency and nature of the lost-time injuries.
98. CNSC staff informed the Commission that AECL continues to develop and maintain a comprehensive industrial health and safety program for the CRL site, and added that the frequency of recordable lost-time injuries decreased at the CRL site during the licence period. During this period, AECL has improved numerous aspects of the program based on best industry practices, results from accident investigations and internal audits. CNSC staff rated this safety and control area as satisfactory.
99. In their intervention, the Canadian Nuclear Workers' Council (CNWC) supported the licence renewal for the CRL site and emphasized the role of their members in the safe operation of all facilities. The Commission asked about the effectiveness of this Joint Health and Safety Committee (JHSC). CNWC representatives responded that this committee is mandated by law under the labour legislation. They consider that, although this committee is rather large, due to the large number of unions present, it operates in a satisfactory manner. CNSC staff added that the existence of this committee is a requirement under the *Canada Labour Code*, and that it covers all the occupational health and safety issues, nuclear or non-nuclear, on the site.
100. Based on the above information, the Commission concludes that AECL will provide adequate protection for the health and safety of persons.

### **Environmental Protection**

101. In considering this safety and control area, the Commission evaluated AECL's performances in the following specific areas:
  - AECL's environmental management system;
  - effluents and releases;
  - action level exceedances;
  - environmental monitoring program and groundwater monitoring;
  - fish impingement; and
  - riverbed sediment project.
102. AECL informed the Commission about implementation of their integrated environmental monitoring program that had consolidated various aspects of the monitoring processes at CRL. The program includes ground water monitoring, non-radiological emissions and radiological emissions. AECL presented data on local

airborne and liquid radiological emissions and noted that the presented results indicate stable emissions with decreasing trends for the last two years, during the extended NRU reactor outage.

103. AECL noted that, in addition to monitoring effluents released from the sites, AECL continues to maintain extensive programs to monitor radioactivity in the environment in and around CRL, in order to verify effluent monitoring results and estimate doses to critical groups outside the CRL site boundary. AECL added that the results of the environmental monitoring continue to confirm that radiation doses resulting from CRL operations are well below the regulatory dose limit for members of the public (1 mSv/y (milliSievert per year)) and below the typical background dose from natural radiation in Canada.
104. CNSC staff reported that AECL's performance in this area was satisfactory. Over this licence period, AECL had undertaken a detailed review of the environmental protection program and associated documentation, and implemented several improvements.
105. CNSC staff informed the Commission that the results from the environmental monitoring programs and groundwater monitoring confirm that CRL operations have a low impact on the environment; however, there are legacy groundwater plumes that AECL will continue to address over the next five years under the nuclear legacy liabilities program.
106. CNSC staff further informed the Commission that AECL was required to put in place action levels for control of releases to the environment from licensed facilities. The purpose of action levels is to give early warning to the licensee and the CNSC of a potential loss of control, and the limits, based on regular performance, are set to be well below regulatory limits. CNSC staff stated that no releases airborne or liquid had exceeded AECL's action levels in 2006, 2007 and 2010. In 2008 there were two weekly airborne releases that had exceeded AECL's action levels; however, these values were approximately 0.1% of derived release limits (DRLs). AECL had implemented corrective actions to reduce the probability of reoccurrence. In 2009, associated with the leak of the NRU reactor vessel, the weekly releases for tritium exceeded AECL's action levels for several weeks, but the total tritium releases were a small fraction of DRLs and posed no risk to the environment or the health of persons.

#### *Groundwater Plumes of Radioactive Contaminants*

107. Noting the concerns expressed in the intervention submitted by the Concerned Citizens of Renfrew County, the Commission sought more information on the plumes of radioactive contaminants moving through the active licensed area and into the Ottawa River. AECL representatives responded that the plume originates from the NRX rod bays that were in operation in the fifties, and that AECL had been tracking this plume for the past number of decades. AECL representatives stated that this plume was one of the plumes considered under the Nuclear Legacy Liability Program. They added that AECL has a systematic framework on plume remediation and that the concentration of

strontium in the Ottawa River downstream from CRL site is not measurable. CNSC staff concurred with AECL's statement and added that the plume is well monitored and the flux of strontium into the river is well understood because groundwater flow rates to the river and the concentrations are well mapped.

108. The Commission further inquired about potential impact of the plume on public health and the environment taking into account cumulative effects. CNSC staff responded that all evidence shows that doses to members of the public from all sources of radioactivity from the CRL site are much lower than the regulatory limit of 1 mSv/year, and that there would therefore not be any resulting health effects.
109. Concerned Citizens of Renfrew County, in their intervention, also requested that a complete and comprehensive map and inventory of all known underground waste plumes be produced. The Commission asked AECL representatives for comment. AECL representatives responded that this information is regularly submitted to the CNSC in a variety of reports.
110. Addressing concerns expressed by the Métis Nation of Ontario in their intervention that "groundwater monitoring occurs only every five to ten years", the Commission inquired about the frequency of monitoring. CNSC staff responded that the results of such monitoring are reported to the CNSC quarterly and annually.

#### *Fish Impingement*

111. AECL reported that, as part of the Ottawa Riverbed Sediment Project, impinged fish will be collected during May to December 2011. AECL noted that two previous studies (2001 to 2004) had been conducted to look at fish impingement in both the NRU Reactor and the NRX Reactor (now decommissioned) and the MAPLE reactors. Based on this information, Fisheries and Oceans Canada concluded that the expected ecological impacts of impingement on Ottawa River fish populations is likely insignificant. Continuing fish impingement and environmental monitoring, as well as the development of a predictive model, will confirm the reduction of fish impingement caused by the cancellation of the MAPLE project.
112. CNSC staff reported that they consider the monitoring program to assess the environmental effects of fish impingement to be acceptable. CSNC staff requested more activities from AECL: to address both fish impingement and entrainment in its monitoring program; to perform further studies to determine the factors contributing to fish entrainment and impingement; and to provide information on impingement of lake sturgeon, classified as a species of special concern in Ontario. CNSC staff track these actions through the Environmental Assessment Follow-up program.



*Riverbed Sediment Project*

113. AECL reported that the Ottawa Riverbed Sediment Project was initiated to carry out a detailed examination of the Ottawa River sediment, this project being currently funded under the Nuclear Legacy Liabilities Program. AECL provided details on the results of the studies and analyses of the riverbed contamination. The CNSC has received regular updates on the project progress. Characterization is underway, and a recommended remediation strategy decision is forecasted to be made by 2016.
114. CNSC staff concurred with the information presented by AECL, and noted that the potential risks to members of the public from the riverbed contamination has been determined to be low.

*Conclusion on Environmental Protection*

115. The Commission is of the opinion that, given the mitigation measures and safety programs that are in place or will be in place to control hazards, AECL will provide adequate protection to the environment. The Commission is of the view that AECL's activities related to underground plume monitoring are acceptable.

**Emergency Management and Fire Response**

116. Within this safety and control area, the Commission considered AECL's preparedness and capability to mitigate the effects of accidental releases of nuclear and hazardous substances to the environment, as well as the implementation of a comprehensive fire protection program and fire protection system design, fire safety analysis and fire prevention.

*Emergency Preparedness*

117. AECL stated that their Emergency Preparedness Program was fully implemented and continuously maintained, and informed the Commission that, during the current licence period, the Emergency Operations Centre was activated on seven occasions; however, there were no incidents of significant radiological or chemical releases.
118. AECL further informed the Commission that their Emergency Preparedness Program Manual had been replaced in 2011 with an overview document, a requirements document, and a governing document index. AECL representatives added that they had updated various processes and procedures, as well as the CRL Site Emergency Plan to reflect Provincial Nuclear Emergency Response Plan and International Atomic Energy Agency standards for emergency notifications.

119. AECL noted that, after internal audits performed in March 2008, an Emergency Preparedness Improvement Plan was developed in 2008 and has been followed and annually revised using information from drills, exercises, self-assessments, inspections, audits (most recently in January 2011), general program review, and benchmarking. They added that this plan continues to be implemented, revised and prioritized as new needs arise.
120. CNSC staff informed the Commission that they had conducted inspections of the Emergency Preparedness Program, evaluating both the program and performance aspects. These inspections had resulted in minor action items and some recommendations to improve the program based on best industry practices. CNSC staff rated AECL's performance in this area as satisfactory.
121. CNSC staff noted that recent changes in the Ontario Emergency Response Plan for the CRL site have imposed more stringent requirements to the indoor and outdoor public warning systems within the 9 km primary zone, and stated that they will continue to work together with AECL, the Province of Ontario, and neighbouring communities to ensure that the new requirements are met.
122. Invited by the Commission to comment on AECL's performance regarding emergency management and alerting system, Emergency Management Ontario (EMO) informed the Commission on the Provincial Nuclear Emergency Response Plan (PNERP) and its implementation for CRL. EMO representatives explained that the towns of Deep River and Laurentian Hills, as designated communities under the PNERP, are required to have a nuclear emergency plan that conforms to the PNERP and to implement provincial directives during an emergency response. They added that the municipalities are also responsible for maintaining the appropriate infrastructure, such as emergency centres, communications and other resources. EMO representatives informed the Commission about the responsibilities of the towns of Deep River and Laurentian Hills and AECL under the PNERP, and with respect to indoor, outdoor and general public alerting. EMO representatives pointed out that the Mayors of Deep River and Laurentian Hills had agreed that the current system of loud-hailers mounted on fire trucks does not meet the standards outlined in the PNERP. EMO representatives added that the Mayors had expressed their commitment to ensuring that the standard is met as soon as possible.
123. The Commission asked if there was an alert system across the river and inquired about communication with Québec authorities. AECL representatives responded that on the Québec side, within the Chalk River Laboratories primary zone, there are two cottages and no permanent residences. AECL representatives added that, in a case of emergency, their emergency operations centre notifies, among others, the Sûreté du Québec, which makes decisions about the type of alerting that they wish to do within the province.

124. The Commission further inquired about the accountability and potential measures that could be used to enforce improvements to inadequate external alerting system. EMO representatives responded that there is legislation that outlines the expectations and the accountabilities; EMO is responsible for the PNERP and municipalities are responsible for ensuring that their local activities are aligned with the PNERP. However, EMO can direct the municipalities to respond, but there is no consequences provided in the legislation for inadequate actions or lack of response.
125. Asked about their contribution to the efforts to improve the external alert system in the neighbouring municipalities, AECL representatives explained the role that the Deep River-Laurentian Hills Nuclear Emergency Preparedness Executive Committee plays in supporting local efforts to improve the system.
126. The Commission asked CNSC staff if they monitor the activities related to emergency management in affected municipalities. CNSC staff responded that they have mechanisms in place and they communicate with EMO. They added that they were ensuring, through inspections, that licensees were meeting the requirements of the PNERP or the relevant provincial legislation to support the offsite authorities.
127. The Commission sought more information from the Mayors of the towns of Deep River and Laurentian Hills on their role in a case of emergency and on communication between them, AECL and the provincial authorities. Mayor R. Rabishaw, the Chair for the Emergency Management for the towns of Laurentian Hills and Deep River, explained the lines of communication, notification sequences and current efforts to improve the alerting system by the better positioning of sirens. The Mayor noted that the newly appointed coordinator works very closely with representatives from AECL and representatives from the EMO. AECL representatives explained their role in notifying the communities and informed the Commission about distribution scenario for potassium iodide (KI) tablets in the case of irradiation, internally to their employees and externally to the public. EMO representatives clarified that the internal distribution of KI tablets lies under AECL authority, while the decision to provide KI to the public is made by the Chief Medical Officer of Health for the province.
128. The Commission sought more information about full-scale exercises conducted within the municipalities. EMO representatives responded that in such exercises, all levels of government are included, the provincial and municipal emergency operations centres are fully operational and the AECL emergency resources are fully activated. Such an exercise, which tests all aspects of the system and not its isolated components, was last performed in 2007. EMO representatives added that municipalities could make a request to the EMO to organize a full-scale exercise. They said that preparations for such an event last about 18 months and that a date for the next full-scale exercise in communities surrounding CRL site has not yet been set. EMO representatives also noted that they exercise the nuclear emergency plans separately from their general emergency plan exercises with municipalities.

129. The Commission asked about the frequency of the exercises organized by the CNSC. CNSC staff responded that they organize multiple levels of exercises; the exercises on the site itself that the licensee must conduct, and the exercises that would encompass the community outside the facility. CNSC does verification on all the CRL exercises, and those are typically held on an annual basis. During these exercises, the interactions with the EMO and communication systems are tested.

*Fire Protection*

130. With respect to the Fire Protection Program, AECL informed the Commission that services include fire suppression, fire investigation, fire prevention inspections, fire related processes, fire protection change control processes, fire hazard analyses, fire safety clearances, employee education and wildland fire prevention. AECL pointed out that the CRL Fire Operations also assists community-based emergency services through Mutual Aid agreements and training support. AECL provided details on the improvement initiatives implemented during the current licence period. CNSC staff concurred with the above information.
131. CNSC staff reported that they have reviewed documentation supporting the closure of action items from the 2004 fire protection review of the CRL site. CNSC staff concluded that the documentation supports the closure of the majority of the 2004 fire protection audit and actions. CNSC staff considers the progress and path forward acceptable for the actions that remain open.
132. CNSC staff noted having performed a fire protection compliance inspection for the CRL site in June 2008 and concluded that, in general, the operation of the CRL site was found to have improved significantly since the CNSC staff's fire protection inspection carried out in November 2004. CNSC staff considers that the progress for addressing the directives and action notices resulting from this inspection is acceptable, and that the present remaining open actions do not present a risk to persons and the environment in the short term, but must be addressed to further increase the level of safety at the CRL site. CNSC staff added that another compliance inspection on the Industrial Fire Brigade in October 2009 led to the conclusion that the fire emergency response capability and performance of the brigade was found to meet licence conditions and CNSC staff's expectations.

*Conclusion on Emergency Management and Fire Response*

133. The Commission is of the opinion that AECL will provide adequate protection to the health and safety of persons, the environment and national security in cases of emergency and unplanned events.

## **Waste Management and Decommissioning**

134. Considering this safety and control area, the Commission reviewed the following specific areas:
- waste management program;
  - waste management facilities;
  - waste repatriation; and
  - CRL Comprehensive Preliminary Decommissioning Plan (CPDP).
135. AECL representatives informed the Commission on development and implementation of their Waste Management Program and decommissioning activities. The Waste Management Program reflects AECL's policy on the environment with regard to the management of both radiological and non-radiological wastes and establishes requirements and processes to ensure that activities involving planning for, handling, processing, transportation, storage and disposal of wastes are performed in a manner that protects the workers, the public, and the environment, and are in compliance with applicable regulatory and site licence requirements. This program comprises waste management minimization, segregation and characterization.
136. AECL representatives further informed the Commission that CRL had successfully returned spent fuel from the pool test reactor to the U.S, decommissioned and dismantled the radioisotope laboratory from the 1950s, and characterized and recovered six historic waste sites. AECL representatives noted that these activities had contributed to a reduction of the liabilities associated with the site. AECL representatives also noted that they had constructed four new waste management facilities, a waste analysis facility, two shielded modular aboveground storage units and a bulk material landfill.
137. CNSC staff informed the Commission about their assessment of CRL's several operating and non-operational Waste Management Areas (WMAs). CNSC staff concluded that the operation of the waste management facilities at CRL are conducted in compliance with the NSCA, its *Regulations*, and the FA documents for the waste management facilities.
138. CNSC staff added that AECL had implemented requirements and expectations for waste minimisation, segregation and characterisation, and has been developing a detailed Integrated Waste Plan to include future radioactive waste streams generated at the CRL site. CNSC staff rated this safety and control area as satisfactory.
139. With respect to the CRL's Comprehensive Preliminary Decommissioning Plan (CPDP), CNSC staff informed the Commission that they had completed the assessment of the revised CPDP and found that it is consistent with the guidance contained in CNSC Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities*. This document includes the strategy, scope, planning assumptions and schedule as they apply to the decommissioning of the CRL site, and needs to be reviewed or revised as required by the Commission, or no later than ten years from the previous revision. CRL's CPDP was last revised in November 2010.

### *Conclusion on Waste Management and Decommissioning*

140. Based on this information, the Commission considers that the waste management activities at the CRL site are in compliance with applicable regulatory and licence requirements, and that the preliminary decommissioning plan are acceptable for the purpose of the current application for licence renewal.

### **Security**

141. With respect to site security issues, the Commission considered relevant information that was provided by AECL and CNSC staff in separate protected CMDs.
142. The Commission concludes that AECL has made adequate provisions for ensuring the physical security of the facility, and is of the opinion that AECL will continue to make adequate provisions during the proposed licence period.

### **Safeguards and Non-Proliferation**

143. The CNSC's regulatory mandate includes ensuring conformity with measures required to implement Canada's international obligations under the Treaty on the Non-Proliferation of Nuclear Weapons. Pursuant to the Treaty, Canada has entered into safeguards agreements with the IAEA. The objective of these agreements is for the IAEA to provide credible assurance on an annual basis to Canada and to the international community that all declared nuclear material is for peaceful, non-explosive uses and that there is no undeclared nuclear material or activities in this country. In considering this safety and control area, the Commission reviewed the licensee's safeguards program and procedures, International Atomic Energy Agency (IAEA) verification activities, and CNSC staffs' inspection results.
144. AECL representatives informed the Commission about their Nuclear Materials and Safeguards Management Program and implementation of safeguards measures under the State-Level Integrated Safeguards approach for Canada. They added that, to support Integrated Safeguards, AECL had become fully compliant with the new Regulatory Document RD-336, *Accounting and Reporting of Nuclear Material*. They added that their near real-time nuclear material accounting system had ensured that AECL is in full compliance with all nuclear materials accounting and reporting requirements.
145. AECL representatives further informed the Commission that AECL had installed remote monitoring equipment in the Molybdenum-99 Production Facility and the NRU reactor facility, which will help the International Atomic Energy Agency (IAEA) staff to reduce the length of their on-site inspections.

146. CNSC staff informed the Commission about IAEA and CNSC verification activities and said that, since November 2009, a new safeguards approach had been implemented at the CRL site. They said that during the review period, the IAEA, with the participation of CNSC staff, conducted four physical inventory verifications at the CRL site, 25 random inspections, monthly inspections of unirradiated, direct-use material from August 1, 2008 to October 31, 2009, and quarterly inspections of all irradiated nuclear material. In addition, 52 IAEA design information verifications and 13 complementary accesses were carried out. CNSC staff noted that AECL had provided the IAEA with the necessary access and assistance to perform their activities and fully complied with IAEA and CNSC requests. AECL had also provided all records and reports in a timely manner as required by the regulations and licence conditions.
147. The Commission inquired on the monitoring of bilateral arrangements between Canada and the USA regarding the repatriation of highly enriched uranium irradiated fuel from CRL to the USA. CNSC staff responded that, since 1955, there is a Bilateral Nuclear Cooperation Agreement between Canada and the United States, under which the two countries can exchange nuclear material, equipment and technology under certain conditions. The material for repatriation is subject to the safeguards agreement between Canada and the IAEA, and it is therefore examined by the IAEA when it makes its inspections. It is also subject to periodic visits by the USA officials who come to examine the security arrangements under which that material is being held. The Commission asked if the IAEA inspects the material after repatriation to the USA. CNSC staff responded that the USA has their arrangements with the IAEA and when that material is returned to the United States, it is not subject to the same safeguards as in Canada.
148. The Commission further inquired how easily a production of molybdenum-99 could be converted from highly enriched to low enriched uranium. AECL representatives responded that the operation would require a significant amount of effort that includes some technical uncertainty, and that the timeframe would certainly go beyond 2016.
149. Based on the above information, the Commission is satisfied that AECL has made and will continue to make adequate provisions in the areas of safeguards and non-proliferation at the CRL site that are necessary for maintaining national security and measures necessary for implementing international agreements to which Canada has agreed.

### **Packaging and Transport**

150. Specific topics considered by the Commission within this safety and control area include AECL's radioactive material transportation program, AECL's unplanned event reports and CNSC inspection results.

151. AECL representatives informed the Commission about the changes and improvements they had made in their Radioactive Material Transportation Program documentation and said that the program manual had been replaced by separate documents, which describe transportation program, requirements and process, and provide transport documentation index and definitions.
152. AECL representatives also informed the Commission that AECL had become a member of the Canadian Nuclear Association's working group on radioactive material transportation.
153. CNSC staff confirmed that AECL had made improvements to the program and had demonstrated compliance with the *Packaging and Transport of Nuclear Substances Regulations* and the *Transportation of Dangerous Goods Regulations*. CNSC staff rated this safety and control area as "satisfactory".

#### **Application of the *Canadian Environmental Assessment Act***

154. Before making a licensing decision, the Commission must be satisfied that all applicable requirements of the *Canadian Environmental Assessment Act*<sup>6</sup> (CEAA) have been fulfilled.
155. CNSC staff indicated that the application to renew the licence for the facility under subsection 24(2) of the NSCA is not prescribed for the purposes of paragraph 5(1)(d) of the CEAA in the *Law List Regulations*<sup>7</sup>. Since there are no other CEAA triggers for this project that involve the CNSC, CNSC staff stated that an environmental assessment (EA) under CEAA for the purpose of this licence renewal is not required.
156. Although no EA is required for the CRL site licence renewal, CNSC staff pointed out that several ongoing projects at the CRL site require EAs. The list of these projects include the following:
  - decommissioning projects for the facilities in a Storage-with-Surveillance state, which include the following projects:
    - plutonium tower,
    - Nuclear Research eXperimental (NRX) Reactor - Ancillary Buildings,
    - plutonium recovery laboratory, and
    - waste water evaporator.
  - new projects:
    - new dry storage systems, and
    - NRU reactor long-term management project.

CNSC staff noted that AECL was required to submit annual status reports on EA follow-up actions that consolidate progress on activities identified from all EAs for the CRL site. CNSC staff reported that AECL had provided these reports as required.

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<sup>6</sup> Statutes of Canada, S.C. 1992, c. 37

<sup>7</sup> Statutory Orders and Regulations, S.O.R./94-636.



157. Based upon the above assessment, the Commission is satisfied that an environmental assessment under the CEEA is not required for AECL's application for licence renewal.

### **Cost Recovery**

158. CNSC staff informed the Commission that fees were charged on an annual basis and were paid by AECL on a quarterly basis.

### **Financial Guarantees**

159. In order to ensure that adequate resources are available for a safe and secure future decommissioning of the CRL site, the Commission requires that an adequate financial guarantee for realization of the planned activities is put in place and maintained in a form acceptable to the Commission throughout the licence period.
160. CNSC staff informed the Commission that the cost for the decommissioning of the CRL site based on the revised CRL Comprehensive Preliminary Decommissioning Plan (CPDP) is currently estimated to be \$3.08 billion. CNSC staff acknowledged that the CPDP and its basis for cost estimates would undergo several revisions during the operational life of the CRL site.
161. Based on this information, the Commission considers that the preliminary decommissioning plans and related financial guarantee are acceptable for the purpose of the current application for licence renewal.

### **Nuclear Liability Insurance**

162. CNSC staff informed the Commission that there is no requirement at present to have any nuclear liability insurance coverage for the CRL site; however, in cases when a licensed facility is capable of initiating a nuclear criticality event, the facility is classed as a nuclear installation. CNSC staff stated that the *Nuclear Liability Act* will ensure that funds are available from the operators of nuclear installations to provide financial compensation to third parties for injuries or damage suffered as a result of a nuclear incident. CNSC staff anticipated that during the term of the proposed five-year licence, nuclear liability insurance would be required.

### **Nuclear Legacy Liability Program**

163. The Nuclear Legacy Liability Program (NLLP) had been established in 2006 to reduce federal nuclear legacy liabilities in a safe and cost-effective manner. Under the program, AECL is responsible for continued care and maintenance of legacy waste areas and buildings at the CRL site, and other locations in Canada, as well as remediation activities to minimize the impact of past initiatives. CNSC staff informed the Commission about the progress that AECL had made and noted the achievements in infrastructure decommissioning, environmental restoration and improved management of legacy radioactive waste.
164. CNSC staff said that they had overseen activities related to the NLLP projects, such as repatriation of the Pool Test Reactor spent highly enriched uranium fuel rods to the U.S.A., construction of the waste analysis facility, and characterization of contaminated sediments in the Ottawa River. CNSC staff added that they had accepted the plan for the second phase of the NLLP (2011-2016), according to which AECL intends to continue with liability reduction through decommissioning, environmental restoration, waste management as well as care and maintenance activities.
165. The Commission sought more information on the commitment that the Government of Canada has regarding the nuclear legacy liability and related waste located at the CRL site. A representative of Natural Resources Canada (NRCan) responded that the commitment of the Government of Canada is to handle everything that is related to the legacy waste, for an estimated time period of about 70 years. The NRCan representative added that, with respect to the allocated budget related to specific activities, the government had decided to proceed with an increment of three years during the restructuring period, so that financing of the program is established for this and the following two fiscal years.
166. Concerned Citizens of Renfrew County, in their intervention, complained about the lack of clarity about the role of the CNSC and other government agencies involved in environmental assessments of projects that are funded by the NLLP. AECL representatives responded that the program is based on a 70-year schedule that is in place until the complete decommissioning of the Chalk River site. The program started in 2006 and is based on a comprehensive preliminary decommissioning plan for the site. AECL representatives explained the role of different government agencies and noted that the NLLP document includes a lot of the information that has been referred to by the intervenor. AECL representatives added that revisions and updates of the document would be promptly posted on AECL's web site.

### **Long term Plan and Significant Future Activities at CRL beyond 2016**

167. AECL representatives informed the Commission about restructuring caused by the Government of Canada's decision, made between the Public Hearing Day One and Day Two, to separate the commercial side of the company from the operation of the main nuclear laboratory. They noted that AECL will remain a nuclear science and technology organization, and will be a Crown Corporation principally comprising the nuclear laboratories. AECL representatives added that AECL's ownership and policy mandate would rest with the Government of Canada; AECL would report to Parliament through the Minister of Natural Resources and would continue to be governed by a board of directors and a chief executive officer.
168. AECL representatives stated that the nuclear laboratories would be reliant on funding from the Government of Canada, including future investments, and that this funding would enable continued expenditures in the critical infrastructure of the nuclear laboratories in general, and the Chalk River Laboratories in particular.
169. The Commission invited representatives of NRCan to provide more information on the future of the CRL site and plans for the period beyond 2016. NRCan representatives responded that, after the completed Phase 1 of the restructuring of AECL, they were proceeding with finalizing the analysis of the options that would be brought forward for a ministerial decision on what would be the preferred path to be explored. To make this decision, it would be necessary to take into account the result of Phase 1 of the restructuring, as well as determining what would be the most appropriate management structure, governance structure, the operational approach and funding approach. The NRCan representative concluded that it was premature at this point to provide any guidance, before the decisions of the government were made on what would be the preferred approach and the path forward. According to the NRCan representative, such a decision could be expected in about two years.
170. The Commission expressed concerns regarding the timelines that would enable it to review in a timely manner all safety aspects of decisions and proposals that would be brought forward. NRCan representatives responded that the only existing decisions about the NRU was that it would stop the production of medical isotopes, and that there were no decisions made about ceasing or continuing the operation of the NRU past 2016. The Government's decision on this matter could be expected by the end of 2014. NRCan representatives reiterated that the Government of Canada has an ongoing long-term commitment regarding nuclear legacy liability.
171. The Commission inquired on the potential impact that the end of isotope production in 2016 and the potential reduction of activities at CRL site could have on the neighbouring communities. The representatives of the municipalities responded that the operation of a research reactor is vital for the community, as well as for the whole country, and that the Government of Canada should support this industry past 2016.

### **Public Information Program and Aboriginal Consultation**

172. AECL representatives presented their Public Information Program and informed the Commission about quarterly meetings with municipal officials of Renfrew and Pontiac Counties, and bilingual community newsletters mailed to residences and businesses. They also informed the Commission about the Environmental Stewardship Council launched in 2006 to enhance communications with key stakeholders and communities surrounding the CRL site.
173. AECL representatives explained that the Environmental Stewardship Council includes representatives from local stakeholder groups such as First Nations, municipal governments, environmentally focused organizations, and landowner associations. Council meetings, where the members are updated on activities at the CRL site that could have an impact on their communities, are held a minimum of three times per year.
174. AECL representatives added that AECL uses its website to present to members of the public the company's environmental and health and safety policies, summaries of radiation doses and environmental monitoring data, as well as updates to specific activities. The website also provides links to relevant supporting technical documents.
175. CNSC staff informed the Commission that AECL had enhanced its voluntary public disclosure of activities related to the CRL site, in addition to other existing protocols. CNSC staff stated that they were fully satisfied with AECL's efforts to ensure effective aboriginal, stakeholder, and public information and consultation activities for the CRL site.
176. CNSC staff added that they observe all Council meetings and are available to answer any regulatory questions. They said that they had made a presentation on the availability of the new Participant Funding Program at the February 9, 2011 Council meeting.
177. CNSC staff further informed the Commission that they had conducted research to identify Aboriginal groups that may have an interest in the renewal of the CRL operating licence. CNSC staff noted that there are no treaties in place within the boundaries of the CRL site. Although the Algonquins of Ontario, which represent ten First Nations, are in land claim negotiations in the vicinity of CRL, the CRL site has not been identified as an area of interest in the land claim negotiation process.
178. CNSC staff also reported that, in April 2011, the availability of funding, under the new CNSC Participant Funding Program, had been announced, to assist applicants wishing to participate in the review of CRL site operating licence renewal application. Each of the identified Aboriginal groups was also sent information relating to the Participant Funding Program. Funding from this program was requested and granted to the Métis Nation of Ontario to assist with their participation in this licence renewal process.

179. An intervenor presented highlights of his survey entitled "Young People and Nuclear: Awareness and Attitudes among Youth Living Near Chalk River Laboratories", which has been funded through the CNSC's Participant Funding Program. The survey had been conducted at McKenzie High School in Deep River and in the General Panet High School in Petawawa. The survey was distributed to 195 youth aged between 14 and 19, and 193 of them had completed it. The summary of the results shows that levels of awareness with respect both to nuclear energy and to CRL are low, 48.2% and 42.3% respectively. The study also showed that 48.9% of respondents recognize that radiation is safe at controlled levels, while 36.8 believe that exposure to radiation is always dangerous. About one half of respondents (53.4%) are aware that nuclear waste is stored at CRL, and the majority of respondents (72.6%) are not aware of an emergency plan for their community in the event of an emergency at CRL.
180. Asked to comment on the results of the survey, CNSC staff responded that they would consider the results through regular reassessments of their outreach programs particularly in the segments related to youth. AECL noted that they have a positive working relationship with the School Board of Renfrew County and with the municipality that could be used to move forward and improve the situation. Asked if they are considering allowing visits of the CRL site to the general public, AECL representatives responded that they are considering wider opening of their facilities to the scientific community and to increase the inflow of students through the site. They added that the opening of the Visitation Centre continue to pose certain challenges to AECL's security apparatus, but they were exploring every possibility to do so.
181. The Canadian Nuclear Association (CNA), in their intervention, supported the licence renewal and emphasised that they have a high school education program endorsed and approved by all Ministries of Education across the country which is available to teachers for their curriculum in high schools. CNA representatives stated that their priority in 2012 is to review this education program and collaborate with science coordinators of school boards to ensure that the program is reaching its intended audience. The Commission asked about the uptake of some of those school programs; CNA representatives responded that they have data for some provinces and territories, but not for the entire country.
182. The Commission further inquired on basic data that could be used by the CNA to measure progress of their programs over time. CNA representatives responded that they have a five-year strategic plan that is based on scientific research. CNA representatives said that they have developed a simplified computer model that measures progress of programs and public perception.
183. The Commission expressed its expectations that the CNA would use the next opportunity to appear in front of the Commission and present the summary of the results of their studies.

184. Based on this information, the Commission is satisfied that AECL's public information program meets regulatory requirements and is effective in keeping the public informed on the facility operations.

### **Licence Length and Conditions**

185. AECL has applied to have its operating licence for the CRL site renewed for a period of five years. Based on their review of AECL's performance and programs and rating of all safety and control areas, CNSC staff recommended that the Commission renew AECL's licence for five years with a number of conditions. CNSC staff have developed a Licence Conditions Handbook (LCH) documenting the compliance verification criteria for the proposed conditions.
186. Concerned Citizens of Renfrew County, in their intervention, recommended to the Commission to split the operating licence for the CRL site into several licences so that different facilities are licensed for different periods of time, most of them not exceeding two years. According to their recommendation, the NRU reactor should operate under a separate licence issued for a period of 12 to 18 months. Asked by the Commission to comment, CNSC staff stated that there is an established procedure for licensing of nuclear facilities, which has been followed. This procedure includes defined safety and control areas for rating an applicant's past performances and ability to meet regulatory requirements and conditions. CNSC staff stressed that they consider the whole picture related to safe operation, rather than separate parts of such complex facilities. CNSC staff explained that, in the past, they had had difficulties presenting the full picture to the Commission for sites where different facilities of a site were regulated by separate licences.
187. With respect to suggested shorter licence periods, CNSC staff stated that, due to long preparations and thorough reviews and evaluation of materials submitted by applicants in support of their request, shorter periods would be counterproductive. Thus, most of the time would be spent in reviewing licence documentation instead of inspecting and monitoring the safety of operations and the progress in the implementation of licence conditions. CNSC staff is of the opinion that a five-year licence brings the proper balance between these aspects of the process.
188. Based on the above information and considerations, the Commission is satisfied that a five-year licence with annual reports on compliance monitoring and operational performance is appropriate. The Commission accepts the licence conditions as recommended by CNSC staff.

## CONCLUSION

189. The Commission has considered the information and submissions of CNSC staff, AECL and all participants as set out in the material available for reference on the record, as well as the oral and written submissions provided or made by the participants at the hearing.
190. The Commission concludes that an environmental assessment of the proposed continued operation of the facility, pursuant to the *Canadian Environmental Assessment Act* is not required.
191. The Commission is satisfied that AECL meets the requirements of subsection 24(4) of the *Nuclear Safety and Control Act*. That is, the Commission is of the opinion that AECL is qualified to carry on the activity that the proposed licence will authorize and that AECL will make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.
192. Therefore, the Commission, pursuant to section 24 of the *Nuclear Safety and Control Act*, renews AECL's operating licence for its CRL site. The renewed licence will be valid for a period of five years.
193. The Commission includes in the licence the conditions as recommended by CNSC staff and set out in the draft licence attached to CMD 11-H7.D.
194. With this decision, the Commission requests that AECL prepare yearly reports on compliance monitoring and operational performance. In addition, with respect to operation of the NRU Reactor, the Commission expects to receive AECL's report on progress made regarding the reactor vessel inspection by the end of February 2012. The Commission requests that CNSC staff also prepare annual reports on the results of compliance activities and present these reports at public proceedings of the Commission.



Michael Binder  
President,  
Canadian Nuclear Safety Commission

DEC 29 2011

Date

**Appendix A – Intervenors**

Intervenors	Document Number
Nordion represented by T. Benjamin	CMD 11-H7.3
Town of Deep River represented by D. Thompson	CMD 11-H7.4
Lantheus Medical Imaging, Inc. represented by C. Villeneuve and I. Goldman	CMD 11-H7.5
Canadian Nuclear Workers’ Council represented by D. Shier, G. Peplinski, G. Tapp and V. Frisna	CMD 11-H7.6
Best Theratronics and the Cancer Centre of Southeastern Ontario (CCSEO) Medical Physics Department represented by J. Schreiner and R. Wassenaar	CMD 11-H7.7
Eric Campbell	CMD 11-H7.8 CMD 11-H7.8A
Canadian Nuclear Association represented by D. Carpenter and K. Olson	CMD 11-H7.9
Métis Nation of Ontario	CMD 11-H7.10 CMD 11-H7.10A
Deep River Science Academy represented by C. Turner	CMD 11-H7.11
Eugene Sokolov	CMD 11-H7.12
Concerned Citizens of Renfrew County represented by O. Hendrickson	CMD 11-H7.13 CMD 11-H7.13A CMD 11-H7.13B
Renfrew County District School Board	CMD 11-H7.14
Ontario Power Generation	CMD 11-H7.15
National Research Council Canada	CMD 11-H7.16