



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire

Record of Proceedings, Including Reasons for Decision

In the Matter of

Applicant Canadian Light Source Inc.

Subject Application to Renew its Particle Accelerator
Operating Licence

Public Hearing
Date May 2, 2012

RECORD OF PROCEEDINGS

Applicant: Canadian Light Source Inc. (CLS)

Address/Location: 101 Perimeter Road, University of Saskatchewan, Saskatoon,
Saskatchewan S7N 0X4

Purpose: Application to renew the Class IB Particle Accelerator Operating
Licence

Application received: January 31, 2012

Date of public hearings: May 2, 2012

Location: Canadian Nuclear Safety Commission (CNSC) Public Hearing
Room, 280 Slater St., 14th. Floor, Ottawa, Ontario

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

Secretary: M.A. Leblanc
Recording Secretary: S. Dimitrijevic
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Licence: Renewed

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INTRODUCTION

1. Canadian Light Source Incorporated (CLS) has applied to the Canadian Nuclear Safety Commission¹ for the renewal of the Class IB particle accelerator operating licence for its facility located on the campus of the University of Saskatchewan in Saskatoon, Saskatchewan. The current operating licence, PA1OL-02.04/2012, expires on May 31, 2012. CLS has applied to renew its licence for a period of ten years.
2. The CLS facility is a national synchrotron radiation facility that consists of three major systems: a linear accelerator, a booster synchrotron and a storage ring with a circumference of about 170 m, which keeps electrons circulating at 2.9 GeV (gigaelectronvolts) for several hours. The CLS facility produces synchrotron radiation that is used as a light source for experiments in diverse fields. CLS operates its facility as a separate, non-profit corporation, wholly owned by the University of Saskatchewan.
3. Synchrotron light sources produce electromagnetic radiation and a very small amount of radioactive material, mostly by the activation of components through interaction with the electron beam. The emission of any high-energy radiation stops instantaneously as soon as the electrons stop circulating in the ring (i.e. after turning off the accelerator systems).

Issue

4. In considering the application, the Commission was required to decide, pursuant to subsection 24(4) of the *Nuclear Safety and Control Act*² (NSCA):
 - a) if CLS is qualified to carry on the activity that the licence would authorize; and
 - b) if, in carrying on that activity, CLS 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.

Public Hearing

5. The Commission, in making its decision, considered information presented for a public hearing held on May 2, 2012, in Ottawa, Ontario. The public hearing was conducted in accordance with the *Canadian Nuclear Safety Commission Rules of Procedure*³. During the public hearing, the Commission considered written submissions and heard oral presentations from CNSC staff (CMD 12-H4, CMD 12-H4.A) and CLS (CMD 12-H4.1). The Commission received no requests for intervention.

¹ 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.

² Statutes of Canada, S.C. 1997, c. 9.

³ Statutory Orders and Regulations, S.O.R./2000-211.

DECISION

6. Based on its consideration of the matter, as described in more detail in the following sections of this *Record of Proceedings*, the Commission concludes that CLS is qualified to carry on the activities that the licence will authorize. The Commission is of the opinion that CLS, 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 Particle Accelerator Operating Licence issued to Canadian Light Source Incorporated for its Canadian Light Source facility located on the campus of the University of Saskatchewan in Saskatoon, Saskatchewan. The renewed licence, PA1OL-02.00/2022, is valid from June 1, 2012 to May 31, 2022.

7. The Commission includes in the licence the conditions as recommended by CNSC staff and set out in the draft licence attached to CMD 12-H4. The Commission also accepts CNSC staff's recommendation regarding the delegation of authority in the draft Licence Conditions Handbook (LCH). The Commission notes that CNSC staff can bring any matter to the Commission as applicable. The Commission directs CNSC staff to inform the Commission on an annual basis of any changes made to the LCH.
8. With this decision, the Commission directs CNSC staff to provide annual reports on the performance of CLS, as part of annual safety performance report on the use of nuclear substances in Canada. CNSC staff shall present these reports at public proceedings of the Commission, in the fall of each year.

ISSUES AND COMMISSION FINDINGS

9. In making its licensing decision, the Commission considered a number of issues relating to CLS'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.
10. CNSC staff informed the Commission that they have reviewed CLS's licence renewal application and found that the submitted application was complete and met the CNSC regulatory requirements.

Management System

11. CLS reported that the CLS quality assurance system, based on ISO 9001 principles, complies with CNSC expectations, as well as with all federal, provincial and municipal requirements. CLS noted that annual management reviews were conducted by the Executive Director and the senior management team to determine the effectiveness and suitability of the management system and to address any need for changes.
12. CLS further informed the Commission about their Health, Safety and Environment Management System (HSEMS) and the Board of Directors' Health, Safety and Environment Committee (HSEC). CLS noted that a Health, Safety and Environment (HSE) manager was appointed to ensure compliance with regulatory requirements and to manage the day-to-day HSE function. This manager has the authority to make safety decisions independent of cost and schedule. CLS further stated that the HSEC meets regularly to ensure the effectiveness of their HSE and quality assurance programs and recommend changes when necessary.
13. CLS noted that they had commissioned an independent assessment by industry experts in 2008. The assessment confirmed that there had been a shortfall in the quality system, which reflected the changes related to the transition from the construction and commissioning phase to the user phase of the CLS facility. As a result of the recommendations by the industry experts and from the CNSC staff audit of 2008, CLS hired a dedicated Quality Manager in early 2009 to develop the quality system framework to address the issues related to the transition and to ensure the consistent application of the quality system throughout the CLS facility.
14. CLS had identified, with CNSC staff, eleven core processes, five of which needed further improvements. Over the last two years, CLS has developed these core processes and continues to complete their implementation according to plans agreed upon with CNSC staff. CLS has also revised its Quality System to reflect the facility's transition from the construction and commissioning phase to full operation as a User facility. In addition, CLS has updated and consolidated their HSE programs in the areas of biological, chemical and nanomaterial safety, occupational health and safety, and radiation protection and control. CLS stated that, in the future, CLS would need to review the integration of the work management, change control and configuration management, and non-conformance tools to achieve efficiency and effectiveness of operations.
15. CNSC staff reported that they had conducted an implementation inspection of the Quality Management program in November 2011 to assess the effectiveness of the revised quality assurance program and to assess its compliance with the CNSC requirements. The inspection highlighted that improvements have been made and that on-going plans were in place for implementing the five core processes that were identified as needing improvement. However, CNSC staff had identified some minor weaknesses in the implementation of the revised program and issued five action

notices. CLS's corrective action plan was submitted to the CNSC on February 23, 2012, and CNSC staff found the plan acceptable so that all action notices were closed. CNSC staff is of the opinion that CLS continues to work on implementing its revised quality assurance program in accordance with CNSC regulatory requirements.

16. CNSC staff stated that CLS maintains its management system program in compliance with CNSC's regulatory requirements and rated this safety and control area (SCA) as satisfactory.

Conclusion on Management System

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

Human Performance Management

18. CLS stated that all individuals requiring unescorted access to the CLS facility must successfully complete and maintain their training. The level of training required depends on hazards involved in the work assignment. Implementation of a systematic approach to training has resulted in several training programs and the training system includes identifying needs, training fulfillment, maintaining records, refreshers or retraining, and assessing effectiveness where necessary. The effectiveness of the training system is reported to the senior management team by the Quality Manager twice a year.
19. CLS reported that, in 2011, they formalized and documented the training process and training procedure identifying the scope and responsibilities for training. CLS added that they had also implemented in 2011 the Training Matrix that identifies the level of training, reading and orientations required for each position at CLS. Minimum staffing requirements have also been specified for the CLS facility and documented in the CLS Routine Operation Limits and Conditions document.
20. CLS noted that they have a broad range of very specific training units for external users of the beamlines, and added that, in the future, they plan to include further expansion of formal training to non-technical areas, such as beyond safety policies and processes.
21. CNSC staff reported that CLS continues to maintain its training program and said that this program is regularly assessed during CNSC compliance inspections. CNSC staff added that, during an inspection in September 2009, they had issued an action notice to CLS for not having trained all users in Workplace Hazardous Materials Information System (WHMIS). This action notice has been addressed and CLS now requires all users to complete the required training before being given access to the CLS facility. CNSC staff rated this safety and control area (SCA) as satisfactory.

22. CNSC staff reported that their technical validation procedures related to CLS Human Performance Program had shown that CLS needed to improve their approach to root cause analysis. CLS addressed the issue by having several staff trained in the TapRoot® method of event investigations, and used the method to re-examine past events and established corrective actions, each with assignment of action and completion dates. CNSC staff has found this approach to be satisfactory and concluded that CLS has made improvements in the area of event investigation, and have successfully implemented the TapRoot® method of event analysis.
23. The Commission asked about CLS approach to training of the users of the facility. CLS representatives responded that the training is delivered online. The users have to register and are required to take certain training modules before they are allowed access to the floor. These modules include the Health and Safety Orientation, the Radiation Safety module and WHMIS. The users have to pass an exam with a mark of 80 percent or better to be allowed to enter the CLS facility. Before the users start using the beam line, they have to take a Beam Line Safety Orientation, which has to be retaken every two years. CNSC staff noted that they validate the training during compliance inspections, by verifying the users' knowledge of the radiation safety and that they were satisfied with the results of those verifications.

Conclusion on Human Performance Management

24. Based on its consideration of the presented information, the Commission concludes that CLS has appropriate programs in place and that current efforts related to human performance management provide a positive indication of CLS's ability to adequately carry out the activities under the proposed licence.

Operating Performance

25. CNSC staff informed the Commission that the specific areas that comprise this SCA include facility operating performance, work procedures and events reporting. CNSC staff rated this SCA as satisfactory.

Facility Operating Performance

26. CLS informed the Commission about performing indicators and future plans regarding operation of CLS. They said that CLS has 15 operational beamlines, while six beamlines are under construction. CLS explained that they manage the access of users to the facility for conducting research through a proposal and permit system. All submitted proposals are reviewed for safety, technical feasibility and ethics, if applicable. All general user proposals are peer reviewed for scientific merit, emphasizing the excellence of the proposed science.

27. CNSC staff informed the Commission that they receive annual reports on CLS operating performance.
28. CLS informed the Commission of their intention to add an alternative, known as top-up mode, to their standard mode of operation, which would result in more constant operating conditions for the storage ring and beamlines.
29. The Commission inquired about the intended addition of a top-up mode of operation and asked how this addition would affect physical design, necessary training of the personnel and safety of operation. CLS representatives responded that the introduction of the proposed mode of operation would increase operation efficiency of the facility by removing the constraint that the safety shutters have to be closed in during the operation, without compromising the safety of the personnel. They added that only small technical changes would be required, and that they were doing necessary preliminary safety assessments.
30. CNSC staff commented that the proposed changes will be submitted to the Commission for full technical assessment. Since this type of modification is beyond the scope that is normally authorized by the designated officer, CNSC staff would provide their recommendation to the Commission for a decision in the matter.

Work Procedures

31. CNSC staff informed the Commission that CLS had developed a set of work procedures that cover the four modes of operation of the facility: normal, developmental, maintenance and extended shut-down mode. CNSC staff considered the work procedures for the operation of the CLS facility acceptable.
32. The Commission sought more information on the purpose of CLS's request for reducing the scope of the annual re-validation of beam safety systems. CLS representatives responded that their re-validation program had been developed very early, during the construction and commissioning of the CLS facility, so that the procedure would need to be optimized for the current number of operational beams, in consultation with experts from other similar facilities and CNSC staff.

Event Reporting

33. CLS reported that they consider that, since the licence renewal in 2006, the CLS facility has operated reliably and in conformance with regulatory requirements. Nine incidents were reported to the CNSC during this period, including six after the mid-term report in 2009. One incident was of regulatory significance (the reverse polarity dipole incident) and was discussed at the CNSC public hearing in June 2011 regarding a licence amendment to reflect the modifications to occupancy and access control, and to accept proposed amendments to the CLS Quality Assurance Manual. CNSC staff concurred with CLS and noted that these incidents were minor in nature and had low safety significance

34. CNSC staff further reported that they inspect the CLS facility twice per year and that no major non compliances with the regulatory requirements were found. They added that CLS had addressed all open action notices adequately. CNSC staff reiterated that CLS had improved its event review process by implementing the TapRoot® method of event analysis and said that they would continue to monitor the application of this investigation approach.

Conclusion on Operating Performance

35. Based on its consideration of the presented information, the Commission is satisfied that the operating performance at the CLS facility provides a positive indication of CLS's ability to adequately carry out the activities under the proposed licence.

Safety Analysis

36. CLS informed the Commission about the specific nature of radiological hazards relevant for safety analysis associated with the operation of an electron accelerator, and explained that these hazards fall into the following two categories:

- *prompt radiation* stemming from the interactions of the primary electron beam with surrounding components, which is the highest radiological risk for any accelerator. Shutting off an accelerator will instantly terminate all prompt radiation; and
- *residual radiation* associated with the activation of surrounding accelerator components. This radiation is in a non-dispersible form and is contained within the structure and components of the accelerators. It is many orders of magnitude smaller than the prompt radiation.

CLS concluded that the main radiological hazard associated with the operation of the synchrotron beamlines is in the form of prompt radiation which terminates immediately after shutting off the storage ring, and that the residual radiation fields inside the beamline enclosures are negligible.

37. CNSC staff confirmed that residual radiation from the activated materials represent potential hazard, with produced radiation dose rates many orders of magnitude below those from prompt radiation. They added that most of the generated radioactivity is in non-dispersible form and is contained within the structure and components of the accelerators. They further noted that there was no need for criticality control or continuous heat removal after shutdown, since residual activated materials are not fissile.
38. CLS said that the principal document for safety analysis is the CLS Safety Report and presented a list of other documents describing the safety analyses of CLS operations. They added that the revised Safety Report had been reviewed and accepted by the CNSC staff. CNSC staff concurred with CLS.

39. CLS further informed the Commission that, after the reverse polarity dipole incident in October 2009, an area along the affected transfer line underwent further assessment and corrective actions have been implemented to improve the safety envelope for the accelerator section. In addition, the work management processes and procedures have been reviewed to ensure that the required level of verification was defined and implemented.
40. CNSC staff informed the Commission that, during the current licence period, they had performed compliance inspections twice per year to verify that CLS adequately maintains the safety measures and barriers in accordance with its safety analysis. They added that their evaluation of this SCA had included CLS safety analysis report and hazards and risks analysis of the beamlines.

Conclusion on Safety Analysis

41. On the basis of the information presented, the Commission concludes that the systematic evaluation of the potential hazards and the preparedness for reducing the effects of such hazards is adequate for the operation of the CLS facility and the activities under the proposed licence.

Physical Design

42. CLS informed the Commission that the *CLS Safety Report* describes the design and ability of systems, components and structures to meet and maintain their design basis. They noted that the physical design of the synchrotron beamlines is described in the *Photon Beamlines Safety Guidelines*, and that both documents include a description of the safety systems required to operate the accelerator and beamlines systems safely and in compliance with the regulatory requirements. The safety systems include radiation shielding, access control interlock system, active area radiation monitoring systems, oxygen monitoring systems, and fire detection and suppression systems.
43. CLS added that all these safety systems undergo a thorough verification and explained that the radiation shielding and the Access Control Interlock System (ACIS) for Phase 2 and Phase 3 beamlines were designed and validated, and local shielding had been changed as a result of operational changes and tested. The oxygen monitoring system was verified, and fire protection system certified yearly, while the open area radiation monitoring system was verified and validated twice per year.
44. CNSC staff reported that, following a compliance inspection in April 2010, they had issued six action notices related to CLS radiation monitoring alarm system. In response, CLS has changed its radiation monitoring alarm systems to improve effectiveness and to be clearly visible and audible. CNSC staff were satisfied that CLS had improved its radiation monitoring system and have closed the action notices. CNSC staff rated this SCA as satisfactory.

45. The Commission sought more information about action notices related to the functioning of the alarm system and asked if there were safety issues. CNSC staff responded that the notices had been issued because the alarm system was not clearly audible and visible, because of an issue with the connection of the radiation monitoring system with the operator's control console, and to deal with some weaknesses in the procedure. CNSC staff added that all issues have been addressed effectively and to their satisfaction.
46. Responding to the Commission's question about frequency of events that have triggered the radiation alarm system, CLS representatives said that the system had been designed to trigger the alarm when the integrated dose is above 5 μ Sv. They added that such events occur two or three times per year.
47. The Commission asked about the expected life time of the CLS facility. CLS representatives responded that the normal life cycle of similar facilities is about 25 years, and added that, in reality, the life time of such facility depends primarily on how long it remains competitive with its offer of the services demanded by external users. CLS representatives added that there were some physical limitations within the facility, such as the space of the concrete shielding that limits the expansion of the accelerator installation.

Conclusion on Physical Design

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

Fitness for Service

49. CLS informed the Commission that the safety systems at CLS were developed and maintained in accordance with the CLS Safety System Development Strategy. They added that all systems undergo annual revalidations and that modifications must be initiated and documented through the Engineering Change Request and Engineering Change Order process, which is used to maintain the configuration of all safety systems. Routine maintenance on safety critical equipment is scheduled and recorded in the CLS maintenance management system. CLS presented all upgrades and additions to the CLS safety systems that were made during the current licence period.
50. With respect to future plans, CLS stated that they would continue with the annual verification and validation of all safety systems, and that CLS plans a third party review of the access control interlock system requirements, design, verification and validation, to further optimize processes relating to safety systems. CLS would like to investigate the possibility of reducing the scope of the annual revalidation to only include tests on systems or components that are not tested or exercised during routine operation of the system. This reduction would reduce the amount of time spent on revalidation without compromising safety of the operation.

51. CNSC staff reported that they had conducted compliance inspections and reviewed CLS records, paying particular attention to calibration records of radiation monitors and survey meters. CNSC staff concluded that CLS adequately maintains its facility to allow safe operation and rated this SCA as satisfactory.

Conclusion on Fitness for Service

52. The Commission is satisfied with CLS'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 CLS is fit for service.

Radiation Protection

53. CLS informed the Commission about their radiation protection and control program, described in detail in the Radiation Protection and Control Manual, and noted that the program is applied in accordance with the As Low As Reasonably Achievable (ALARA) principle. They added that maintenance or implementation of design changes on systems critical to the radiation protection program are controlled as defined in their document Work Management and Configuration Management Process. In addition, CLS has recently implemented a configuration control process that more rigorously defines controlled work and the procedures required to be followed to get appropriate authorization to complete the work.
54. CNSC staff reported that CLS has continued to maintain and implement a comprehensive Radiation Protection program at its facility throughout the duration of the licensing period. CNSC staff added that CLS maintains and implements a residual radiation and contamination monitoring program to control contamination at the facility, and that contamination monitoring continued to be effectively performed at CLS. CNSC staff rated CLS's performance in the area of radiation protection as satisfactory.
55. CLS reported that radiation levels are monitored and routine radiation surveys are performed during operational periods. All personnel are monitored for irradiation individually using Optically Stimulated Luminescence Dosimeters (OSLD), which are also used as passive area monitors at over 500 locations to provide integrated radiation levels throughout and outside of the facility. CNSC staff noted that CLS utilizes a CNSC licensed dosimetry service.
56. With respect to application of the ALARA principle, CNSC staff reported that CLS continues to perform dose planning, mitigation and monitoring, as well as monitoring of the radiation dose levels within and around the facility using passive radiation monitors.

57. CLS further reported that radiation levels during operational periods have been monitored in real time using an Active Area Radiation Monitoring System (AARMS). They added that residual radiation surveys have been completed at the beginning of an extended shutdown period to identify any activated accelerator components, and that special radiation measurements have been conducted during commissioning of new beamlines to validate shielding installations.
58. CLS stressed the importance of the AARMS and said that the update of the system has been completed in 2011. They added that the radiation monitoring at the CLS also includes a Passive Area Radiation Monitoring System (PARMS) where OSLD are strategically located in occupied areas to provide a quarterly integrated dose. In addition to AARMS and PARMS, the Access Control and Interlock System (ACIS) is also a responsibility of the radiation protection program. The system has been upgraded in 2008 and ensures that personnel cannot access potentially high radiation areas when the beam is on.
59. The Commission sought more information about intensity and duration of residual radiation, and resulting risk to the users. CLS representatives responded that the risk from residual radiation exposure is very small and localized in certain areas inside the accelerator enclosures. CLS representatives added that the users are normally not allowed to be inside the machine, even if it is shut down, so that a risk of exposure is minimized.
60. CLS presented to the Commission dosimetry data from 2006 to 2011 and pointed out that the biggest average effective dose received by a nuclear energy worker (NEW) – CLS employee was only 0.1% of the regulatory limit of 50 mSv/y (millisieverts per year), while the biggest maximum individual effective dose during the same period was only about 2% of the regulatory limit. Values for the maximum individual effective doses for non-NEW, that include external users, contractors and some CLS staff, have varied in the range from 5% to 25% of the regulatory limit of 1 mSv/y.
61. The Commission inquired about a worst case scenario. CLS representatives responded that they had simulated such specific event, and the worse that could happen is that the doses would be around 2 to 3 mSv/h (millisieverts per hour). CLS representatives reiterated that amount of residual activation is minimal and localized, so that the risk to the public or the workers is minimal.
62. CLS informed the Commission on their intention to request the removal of personal radiation monitoring devices for non-nuclear energy workers. The Commission asked for more information on this topic. CNSC staff said that they would do a complete assessment upon receiving the request. CNSC staff pointed out that this type of change is one that they would consider as appropriate to make through an amendment to the licence condition handbook.

Action Levels

63. CLS added that the dose action levels currently used at CLS are low compared to both the design objectives of the shielding and the regulations; these values are set at 4% of the regulatory limit for NEW and at 20% of the regulatory limit for non-NEW. CLS noted that these action levels are reviewed annually, and that, during the current licence period, these levels had not been exceeded. Explaining plans for the future, CLS noted that, since the dose to personnel at CLS is historically very low, the main focus of the radiation protection program would not be to reduce the dose further, as much as to maintain the standard that has been set.
64. CNSC staff confirmed that the action levels established at CLS as early warnings for potential loss of control have been set low compared to the regulatory limits, and that they had not been exceeded during the current licence period. CNSC staff also confirmed that CLS maintains and implements a residual radiation and contamination monitoring program to control contamination at its facility.

Conclusion on Radiation Protection

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

Conventional Health and Safety

66. CLS informed the Commission that their Health, Safety and Environment (HSE) department ensures compliance with all applicable federal, provincial and local regulations and standards involving radiation protection and control, environmental health, chemical/biological safety, industrial hygiene, fire safety, and general safety. The same department develops, implements and maintains the Health and Safety Program and procedures for mitigation, which are described in the documents Biological Chemical and Nanomaterial Safety Manuals and Occupational Health and Safety Manual. The HSE department also evaluates risk levels for all experiments, including those proposed by external users.
67. CNSC staff reported that CLS has a suite of documents regarding different conventional hazards and established procedures to ensure the protection of workers from physical, chemical, biological and radiation hazards that may arise in the course of their work at the facility. CNSC staff added that CLS has an occupational health and safety committee that consists of the workers' representative and employer representatives. The committee reviews incidents, conducts safety inspections, evaluates safety programs and recommends health and safety improvements. CNSC staff stated that CLS has developed and continues to deliver safety-related training courses to its employees and contractors.

68. CNSC staff concluded that CLS has effectively implemented and maintained its conventional health and safety program, and rated this SCA as satisfactory.
69. CLS informed the Commission that a CLS occupational Health and Safety Committee meets at least nine times per year and conducts workplace inspections at least once per month.
70. CLS further informed the Commission that, during the current licence period of five years, they had eight minor injuries (for about 1,650,000 hours worked by CLS employees). During the same period, only three lost day injuries by contractor workers were registered, and there were no injuries of CLS employees and external users.
71. The Commission noted that, while there were no lost-time injuries among the CLS employees, the contractors had some, and asked how CLS defines lost-time injuries and what measures have been put in place to train contractors to prevent further injuries in the future. CLS representatives responded that, for lost-time injuries, they consider those cases where workers get injured and are unable to return to work the same day. CLS representatives said that they had had three minor injuries during the last six years, and added that all contractors, before they come on site, have to pass the Contractor Safety Orientation, which is delivered by the University Campus safety staff.
72. With respect to CLS' obligation to be compliant with other agencies, such as *Canadian Occupational Health and Safety Regulations*⁴, Public Health Agency of Canada, *Human Pathogen and Toxins Act*⁵, Canadian Food Inspection Agency and others, the Commission sought more information on inspections done by these agencies. CLS representatives responded that the Saskatoon Fire and Protection Services inspect on a regular basis for fire protection, and that the Canada Labour officer used to come at least once a year to review CLS' yearly report. CNSC staff added that they would inform other agencies and departments in case they find something worth reporting.
73. The Commission noted that there was no provincial monitoring of the occupational health in the CLS facility and asked if CNSC staff monitors the occupational health system in the facility. CLS representatives responded that they have an Occupational Health and Safety Committee that is doing regularly inspections and the reports from these inspections are forwarded to CNSC staff. CNSC staff concurred with CLS.
74. Based on the information provided, the Commission is of the opinion that CLS will provide adequate protection for the health and safety of persons.

⁴ SOR/86-304

⁵ S.C. 2009, c4. 2

Environmental Protection

75. CLS informed the Commission that measurements of the concentrations of radioactive gases, which are short lived, have shown that they have negligible effect on the environment. The residual activity in accelerator components produced at the CLS facility is controlled under the hazardous waste management program. All materials are surveyed prior to their release from the facility to confirm that they are free from radiological contamination.
76. CLS added that dosimeters were deployed at 25 locations around the perimeter of the building accessible to the public and were used to determine exposure to members of the public. The average dose measured in occupied areas was less than 0.1 mSv/y, which is well below the regulatory limit of 1 mSv/y for the public.
77. CNSC staff informed the Commission that CLS has programs to identify, control and monitor all releases of nuclear substances and to minimize the effects on the environment. They added that they had evaluated effluent and emissions releases, environmental monitoring and estimated doses to the public, and confirmed that gaseous radiological releases from the CLS facility to the environment are negligible. CNSC staff concluded that CLS has made adequate provision for protection of the environment and rated this SCA as satisfactory.

Conclusion on Environmental Protection

78. The Commission is of the opinion that, given the nature of releases associated with the CLS facility and safety programs that are in place to control hazards, CLS will provide adequate protection to the environment.

Emergency Management and Fire Protection

79. This SCA comprises specific areas that cover the emergency plans and emergency preparedness programs which exist for emergencies and for non-routine conditions at CLS, and includes conventional emergency response and fire protection and response. CNSC staff rated this SCA as satisfactory.

Emergency Management and Response

80. CLS informed the Commission about their emergency management and explained that CLS cooperates with the University of Saskatchewan (U of S), which has developed an Emergency Measures Policy and corresponding University Emergency Measures Plan that is designed to allow the university to mobilize all the resources needed to deal with an event. CLS also coordinates with external agencies in the types of events that affect the entire campus, including the CLS facility. The external agencies include the Saskatoon Fire and Protective Services, Saskatoon Police Service, and U of S Campus Safety and Waste Management Facility.

81. CNSC staff reported that CLS maintains an emergency program in accordance with CNSC regulatory requirements. The emergency preparedness program and response plan are focused on on-site risks since the off-site radiological emergency risks associated with CLS's operations are very low. CNSC staff is of the opinion that the scope and depth of the CLS's emergency program is commensurate with the risks and is acceptable to CNSC staff.
82. CNSC staff added that CLS had submitted its analysis on "natural disasters" in response to the CNSC information request regarding lessons from the Fukushima's accident and that no changes in current equipment or procedures were required.
83. The Commission sought more information on an emergency shutdown of a beam or a system. CLS representatives responded that users only have access to opening shutters to allow the synchrotron beam into their experimental station and have no authority to shut down the beamline. They added that each beamline is under the responsibility of the beamline scientist or a designate. Regarding the storage ring, the person responsible for the access to operations has the authority to shut down the machine if deemed necessary. CLS representatives further added that there is an emergency button in every hatch that can prevent the start of the operation if, for any reason, somebody remains within the hatch. Also, with any attempt to open the hatch door in violation, the beam is shut off immediately. CLS representatives noted that the accelerator can be safely tripped off within milliseconds, and it would take typically about 15 minutes to a half hour to put the beam back in again.
84. The Commission further inquired about a scenario beyond design analysis, and asked whether a seismic event, while the beam is running, would trigger the beam off. CLS representatives responded that if an event was large enough to shift the beam position by about one millimetre from its reference trajectory, the beam would trip. For lesser vibrations, the existing active systems would compensate the beam position to keep it stable.

Fire Protection

85. CLS informed the Commission that their Fire Protection Plan include planned, coordinated, controlled and integrated activities which are required by regulation, codes and standards listed in the CLS operating license. The plan also includes details of the fire prevention and protection systems, and hazardous materials and substances located in the building.
86. With respect to the Fire Protection Program, CNSC staff stated that CLS has a comprehensive fire protection program in place to minimize both the probability of occurrence and the consequences of fire at the CLS facility. They noted that the program has been established to comply with the requirements of the "*National Building Code of Canada (2005)*" and the "*National Fire Code of Canada (2005)*" (NFCC).

87. CLS noted that the Saskatoon Fire and Protective Services inspect the CLS facility yearly to ensure compliance with the NFCC, and that the annual fire alarm inspections are conducted by an outside agency, in conjunction with the U of S annual fire drill.
88. CLS reported that changes to the fire alarm system are completed by certified fire alarm technicians and reviewed by a third party. All reports are forwarded to the CNSC. CNSC staff added that the third party reviews had confirmed that the inspection, testing and maintenance activities relating to fire safety systems and equipment had met the intent of the NFCC. The deficiencies identified in the third party reviews were minor and have been promptly corrected by CLS.

Conclusion on Emergency Management and Fire Protection

89. The Commission is of the opinion that CLS 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

90. The evaluation of this SCA by CNSC staff included assessment of CLS's waste management program. CNSC staff rated this SCA as satisfactory.
91. CNSC staff stated that CLS had documented its waste management program at its facility and added that the program involves minimizing, segregating, characterizing, storing and disposing of wastes in compliance with licence requirements.
92. CLS informed the Commission that quantities of hazardous waste produced in its facility can be characterized as typical laboratory scale quantities. They said that management of hazardous material is described in the *Biological, Chemical and Nanomaterial Safety Manual*, which provides information on the proper storage, handling, transport and disposal of hazardous waste. CLS added that their HSE department is responsible for the collection, storage and disposal of all hazardous waste, and that all hazardous waste is disposed of through the University of Saskatchewan Waste Management Facility or Envirotec Services.
93. CLS added that only a small amount of waste has been produced at its facility, mostly due to the fact that most of the samples have been prepared at various users institutions. Larger volumes of hazardous waste, such as glycol or waste oils, are disposed of through Envirotec Services. All biological waste is collected, packaged and returned to a user's home facility or disposed of via a private company.
94. CLS further informed the Commission that there were no solid or liquid radioactive wastes generated during this reporting period and there was no deliberate production of radioisotopes. They added that all activated material has been kept in the designated radiological storage areas located within the restricted access zone.

95. CNSC staff confirmed that a small amount of radioactive waste produced at the CLS facility is retained for decay until it reaches background radiation dose rates, and that majority of the hazardous waste is disposed through the Waste Management Facility of the University of Saskatchewan.
96. The Commission sought more information on the volume of hazardous and radioactive waste produced on the site. CLS representatives responded that the amount of hazardous and radioactive waste generated at the CLS facility is rather small, not bigger than typical laboratory wastes on the campus, and could include some activated components from the accelerator, which are stored until they reach a level of activity small enough so that they can be released without any restrictions.

Conclusion on Waste Management

97. Based on the above information and considerations, the Commission is satisfied that CLS is safely managing waste at its facility.

Security

98. CLS reported that its security plan describes the various program elements, roles and responsibilities, and the procedures in place to maintain site security. CNSC staff confirmed the existence of a security program for the CLS facility, which is in accordance with CNSC regulatory requirements. CNSC staff added that they reviewed the facility security plan in February 2012 and found it acceptable.
99. CLS further reported that University of Saskatchewan Safety is the local police force for the university campus, which will contact the Saskatoon Police Service or the RCMP for assistance if required. The HSE Manager is responsible for day-to-day site security and works closely with the University of Saskatchewan to ensure that the CNSC is made aware of any security enhancements or breaches. CLS considers that, since radioactivity in this facility is not in a dispersable form, it does not constitute a security risk in the event of sabotage of the facility.
100. CLS reported that a rigorous verification and ventilation procedure for testing the CLS security system is in place. This procedure includes a video surveillance system and card system. The verification and validation of the CLS security system was completed during the facility shutdown in October 2011. CLS intends on performing validations of this security system twice per year during the scheduled facility shutdown periods in April and October.
101. CLS plans on upgrading and integrating the CLS card access system with the current video surveillance system under the direction of University of Saskatchewan Campus Safety. This new system will be continuously monitored on a 24/7 basis. Design, installation and testing is expected to begin by May 2012. CNSC staff concurred with CLS.

102. CLS stated that there were no reportable security incidents during this licensing period.
103. The Commission is satisfied that CLS's performance with respect to maintaining security at the CLS facility has been acceptable and concludes that CLS has made adequate provision for ensuring the physical security of the CLS facility, and is of the opinion that CLS will continue to make adequate provision for the protection of national security during the proposed licence period.

Safeguards

104. 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 International Atomic Energy Agency (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 used in peaceful, non-explosive manner and that there is no undeclared nuclear material or activities in this country.
105. CLS stated in its submission that this SCA does not apply to CLS, since CLS does not possess any nuclear substances or equipment, nor is it involved in nuclear activities that need to be safeguarded according to the Canada-IAEA Safeguard Agreements. However, they noted that export of certain power supplies would be subject to licensing under the Nuclear *Non-proliferation Import and Export Control Regulations*⁶. CNSC staff expressed the same opinion, since CLS does not possess any nuclear substance or equipment that need to be safeguarded according to the Safeguard Agreement between Canada and the International Atomic Energy Agency.

Packaging and Transport

106. Packaging and transport covers the safe packaging and transport of nuclear substances to and from CLS. CLS must adhere to the *Packaging and Transport of Nuclear Substances Regulations*⁷ and Transport Canada's *Transportation of Dangerous Goods Regulations*⁸ for all shipments leaving the site. The *Packaging and Transport of Nuclear Substances Regulations* apply to the packaging and transport of nuclear substances, including the design, production, use, inspection, maintenance and repair of packages, and the preparation, consigning, handling, loading, carriage and unloading of packages containing nuclear substances.

⁶ SOR/2000-210

⁷ SOR/2000-208

⁸ SOR/2001-286

107. CLS stated that control of the shipping of dangerous goods is accomplished through worker training, hazard identification and proper packaging of dangerous goods. They explained that all CLS staff who receive or ship dangerous goods had received the required training offered by University of Saskatchewan Workplace Safety and Environmental Protection.
108. CLS informed the Commission that they have developed the Procedure for Purchasing, Shipping and Receiving Hazardous Materials and Users' Samples to protect the health and safety of all personnel at the CLS and to maintain compliance with all regulations.
109. CLS added that, during the current licence period, CLS had purchased radioactive sealed sources, as well as some samples of uranium ore and uranium tailings, which were kept on site for the duration of the experiment and then had been returned to the researcher's home institution. CLS said that all sealed sources were stored in a locked cabinet in a secure area and that the CLS HSE department maintains an inventory of all these sources.
110. CNSC staff informed the Commission that CLS complies with the *Packaging and Transport of Nuclear Substances Regulations* and Transport Canada's *Transportation of Dangerous Goods Regulations*. CNSC staff added that CLS employees who handle nuclear substances for the purposes of packaging and transport have received relevant training and that there were no reported packaging and transport related incidents during the current licensing period. CNSC staff rated this SCA as satisfactory.
111. Base on the above information, the Commission is satisfied that CLS is meeting regulatory requirements regarding packaging and transport.

Application of the *Canadian Environmental Assessment Act*

112. Before making a licensing decision, the Commission must be satisfied that all applicable requirements of the *Canadian Environmental Assessment Act*⁹ (CEAA) have been fulfilled.
113. CNSC staff indicated that they were proposing a number of changes, which will not affect the scope of activities authorized under the licence, in order to align the licence with the new Class I licence format. CNSC staff further stated that the renewal of a licence with changes is interpreted as an amendment under subsection 24(2) of the NSCA, which is listed in the *Law List Regulations*¹⁰ as a "trigger" pursuant to paragraph 5(1)(d) of the CEAA. However, since the proposed changes to the licence renewal are all administrative in nature, there are no physical works or undertakings relating to physical works for this licence renewal. As such, there is no "project", pursuant to section 2 of the CEAA. Consequently, CNSC staff is of the opinion that an environmental assessment under CEAA is not required.

⁹ Statutes of Canada, S.C. 1992, c. 37

¹⁰ SOR/94-636.

114. Based upon the above assessment, the Commission is satisfied that an environmental assessment under the CEEA is not required for this application.

Aboriginal Consultation and Public Information Program

115. A public information program is a regulatory requirement for licence applicants and licensed operators of Class I nuclear facilities, such as CLS. Paragraph 3(j) of the *Class I Nuclear Facilities Regulations*¹¹ requires that licence applications include “*the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed.*”
116. CLS informed the Commission that, in addition to health, safety and environmental issues, they inform a broad audience about the on-going activities, scientific results, new plans, and interactions of the CLS with industry as Canada’s national synchrotron facility.
117. CLS presented a full list of their objectives and informed the Commission about their public, private and educational tours, printed and electronic materials, as well as about other activities. They explained that public tours are offered for interested individuals and small groups several days per week, except weekends and statutory holidays. Additional tours for specific activities are conducted on an as-needed basis. For visitors with specific interests, guided tours may be organized through areas that deviate from the designated tour route, including the experimental hall. Special educational tours are offered in support of science curricular goals and objectives in grades five through twelve in coordination with the CLS Educational Outreach Coordinator. In addition, CLS presented a list of printed and electronic materials available on their web site.
118. CNSC staff reported that CLS has documented its public information program and noted that CLS uses the CLS web site as its central repository for the public information material it provides. CNSC further reported that, to supplement information on the web site and for members of the community who may not have access to a computer, CLS also provides a corporate brochure, an annual activity report informing stakeholders of their activities and how to contact them, and an outreach/education program which provides an opportunity for groups to tour the facility.
119. With respect to Aboriginal consultation, CNSC staff informed the Commission that, according to their evaluation of the information provided in the application, CNSC staff have determined that the activities to be regulated under this proposed licence will not cause adverse impacts on potential or established Aboriginal or treaty rights. The common law Duty to Consult with Aboriginal communities and organizations applies when the Crown contemplates actions that may adversely affect established or potential Aboriginal or treaty rights.

¹¹ SOR/2000-204

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

Decommissioning Plans and Financial Guarantee

121. In order to ensure that adequate resources are available for a safe and secure future decommissioning of the CLS facility, the Commission requires that an adequate financial guarantee for realization of the planned decommissioning activities is put in place and maintained in a form acceptable to the Commission throughout the licence period.
122. CLS informed the Commission that CLS has developed a Decommissioning Plan (DP) to outline the activities and expenditures on cessation of operations. The plan involves removing any equipment and structural material that has been exposed to radiation, placing it in the sub-basement and sealing it with additional concrete. The estimated decommissioning cost is approximately \$ 7.5 million. CLS plans on accumulating a fund over the next 30 years to provide for these expenditures, which will also be indexed for inflation.
123. CLS informed the Commission that, until CLS has accumulated enough funding to make it economical to administer a trust fund to the benefit of the CNSC, the financial guarantee is provided by a letter of credit provided by the University of Saskatchewan to the CNSC. The letter of credit is secured for a three-year period until June 30, 2013 and will be automatically extended annually unless the bank notifies the CNSC at least 90 days prior to the annual expiry date.
124. CNSC staff informed the Commission that they have reviewed and accepted CLS's DP in May 2009, and added that they were reviewing an updated DP, which includes the estimated decommissioning cost as a basis for the required financial guarantee. CNSC staff noted that, since the CLS facility has not undergone any operational changes, the 2009 decommissioning plan remains valid and in effect.
125. CNSC staff informed the Commission that CLS currently maintains the required financial guarantee in the form of an irrevocable letter of credit for the value of \$7.5 million. CNSC staff added that decommissioning costs and related financial guarantees are revised by the Commission every five years and noted that the Commission had accepted CLS's financial guarantee for the CLS facility in 2010.
126. Based on this information, the Commission considers that the decommissioning plan and related financial guarantee are acceptable for the purpose of the current application for licence renewal.

Nuclear Liability Insurance and Cost Recovery

127. CNSC staff informed the Commission that CLS is exempted from fees under section 2 of the *Cost Recovery Fees Regulations*¹² as a non-for-profit organization that carries out scientific research.

Licence Length and Conditions

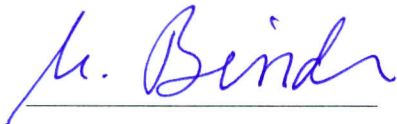
128. CLS has applied, and CNSC staff recommended to the Commission, to renew this operating licence for a period of 10 years.
129. The Commission inquired as to the readiness of the licensee and adequacy of its quality management system for a ten-year licence term, and asked what regulatory requirements would be included in the licence. CNSC staff responded, based on their experience and the commitment that CLS has demonstrated through implementation of their management system, that they were confident that CLS can safely operate the facility throughout a ten-year licence period. CLS representatives noted that their first QA program was conceived for construction and the commissioning of the CLS facility, and that they have recently implemented a new QA program appropriate for CLS as a user-oriented facility.
130. With respect to regulatory requirements and related monitoring of the CLS compliance, CNSC staff stated that annual reporting and activities related to compliance verification along with the licence condition handbook flexibility would be sufficient to effectively manage the compliance verification over a 10-year period.
131. The Commission asked whether the compliance activities, monitoring and inspections depend on the length of the licence period. CNSC staff responded that their approach to compliance verification does not depend on the licence length.
132. Based on the above information and considerations, the Commission is satisfied that a ten-year licence with proposed compliance verification and annual reporting is appropriate. The Commission accepts the licence conditions as recommended by CNSC staff. The Commission also accepts CNSC staff's recommendation regarding the delegation of authority, and notes that it can bring any matter to the Commission as applicable.

CONCLUSION

133. The Commission has considered the information and submissions of CNSC staff and CLS as set out in the material available for reference on the record.

¹² SOR/2003-212

134. The Commission concludes that an environmental assessment of the proposed continued operation of the CLS facility, pursuant to the *Canadian Environmental Assessment Act*, is not required.
135. The Commission is satisfied that CLS meets the requirements of subsection 24(4) of the *Nuclear Safety and Control Act*. That is, the Commission is of the opinion that CLS is qualified to carry on the activity that the proposed licence will authorize and that CLS, in carrying on that activity, 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.
136. Therefore, the Commission, pursuant to section 24 of the *Nuclear Safety and Control Act*, renews Canadian Light Source Inc. Particle Accelerator Operating Licence for its Canadian Light Source facility located in Saskatoon, Saskatchewan. The licence PA1OL-02.00/2022 will be valid from June 1, 2012 to May 31, 2022.
137. The Commission includes in the licence the conditions as recommended by CNSC staff and set out in the draft licence attached to CMD 12-H4, and delegates approval authority under the licence as outlined in the LCH.
138. With this decision, the Commission directs CNSC staff to provide annual reports on the performance of CLS, as part of annual safety performance report on the use of nuclear substances in Canada. CNSC staff shall present these reports at public proceedings of the Commission, in the fall of each year.



Michael Binder
President,
Canadian Nuclear Safety Commission

JUL 11 2012

Date