



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire

Record of Proceedings, Including Reasons for Decision

In the Matter of

Applicant TRIUMF Accelerators Inc.

Subject Application to Renew the TRIUMF Accelerators
Inc. Class IB Particle Accelerator Operating
Licence

Public Hearing
Date May 2, 2012

RECORD OF PROCEEDINGS

Applicant: TRIUMF Accelerators Inc.

Address/Location: 4004 Wesbrook Mall, Vancouver, BC, V6T 2A3

Purpose: Application to Renew the TRIUMF Accelerators Inc. Class IB Particle Accelerator Operating Licence

Application received: November 14, 2011

Date of public hearing: 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 R. Velshi
A. Harvey D.D. Tolgyesi

Secretary: M.A. Leblanc
Recording Secretary: D. Carrière
Senior General Counsel: J. Lavoie

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Licence: Renewed

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INTRODUCTION

1. TRIUMF Accelerator Inc. (TRIUMF) has applied to the Canadian Nuclear Safety Commission¹ (CNSC) for the renewal of the Class IB Particle Accelerator Operating Licence for its accelerator laboratories located on the University of British Columbia's campus in Vancouver, British Columbia. The current operating licence PA1OL-01.07/2012 expires on June 30, 2012. TRIUMF has applied for the renewal of this licence for a period of 10 years.
2. The TRIUMF licensed facilities are used for performing research in nuclear physics, particle physics, molecular and materials science, and nuclear medicine. TRIUMF operates one Class IB² 500MeV proton beam cyclotron accelerator facility, four Class II cyclotron accelerator facilities and three Class II linear accelerator facilities.
3. TRIUMF is also in the process of site preparation to construct a Class II electron linear accelerator facility on the site, designated as the Advanced Rare IsotopE Laboratory (ARIEL).

Issue

4. In considering the application, the Commission was required to decide, pursuant to subsection 24(4) of the *Nuclear Safety and Control Act*³ (NSCA):
 - a) if TRIUMF is qualified to carry on the activity that the licence would authorize; and
 - b) if, in carrying on that activity, TRIUMF 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. Pursuant to section 22 of the NSCA, the President of the Commission established a panel (hereinafter referred to as the Commission) to review TRIUMF's application. 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*⁴.

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 Class I and Class II facilities are defined in the *Class I Nuclear Facilities Regulations* (S.O.R./2000-204) and the *Class II Nuclear Facilities and Prescribed Equipment Regulations* (S.O.R./2000-205), respectively.

³ Statutes of Canada (S.C.) 1997, chapter (c.) 9.

⁴ Statutory Orders and Regulations (SOR)/2000-211.

During the public hearing, the Commission considered written submissions and heard oral presentations from TRIUMF (CMD 12-H5.1) and CNSC staff (CMD 12-H5). The Commission provided the public with an opportunity to be heard on the matter. No interventions were filed by any member of the public.

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 TRIUMF is qualified to carry on the activity that the licence will authorize. The Commission is of the opinion that TRIUMF, 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. Therefore,

the Commission, pursuant to section 24 of the *Nuclear Safety and Control Act*, renews TRIUMF Accelerators Inc.'s Class IB Particle Accelerator Operating Licence for its accelerator laboratories located on the University of British Columbia's campus in Vancouver, British Columbia. The renewed licence, PA1OL-01.00/2022, is valid from July 1, 2012 to June 30, 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-H5. The Commission also accepts CNSC staff's recommendation regarding the delegation of authority in the 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 an annual report on the performance of TRIUMF, as part of the annual report on the safety performance of nuclear substances in Canada. CNSC staff shall present these reports at public proceedings of the Commission.

ISSUES AND COMMISSION FINDINGS

9. In making its licensing decision, the Commission considered a number of issues relating to TRIUMF'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.

Management System

10. The Commission examined TRIUMF's Management System which covers the framework that establishes the processes and programs required to ensure the organization achieves its safety objectives, continuously monitors its performance against these objectives, and fosters a healthy safety culture.
11. TRIUMF reported having made significant progress within its Quality Management System (QMS) program over the licensing period. Among these, TRIUMF reported having completed a significant review and rework of the QMS program which led to a new release of the TRIUMF Quality Assurance Manual along with 13 TRIUMF Standard Operating Procedures (TSOPs) in 2008. TRIUMF stated that goals and objectives, along with metrics, are in place in order to measure performance annually in the area of Quality Management.
12. CNSC staff reported that TRIUMF satisfactorily resolved the remaining six directives and five action notices stemming from the 2006 inspection during the current licence period. CNSC staff also reported that sample checks of various classes of legacy documents were found to be satisfactory during a compliance inspection conducted by CNSC staff in July 2011.
13. With regards to a compliance inspection that was performed in December 2011 to evaluate the ongoing implementation of the quality assurance (QA) program, CNSC staff reported that TRIUMF was found to be proactive in amending their procedures to improve their processes, but that there was a weakness relating to the consistency with the implementation of the Non-conformance Reporting and Resolution procedure. CNSC staff stated that one action notice and three recommendations were issued, but that the deficiency noted does not significantly impede on the safety of operations at TRIUMF. CNSC staff also reported that the action plan submitted by TRIUMF to resolve this weakness was found to be acceptable.
14. CNSC staff stated that they will continue to monitor issues previously addressed to ensure TRIUMF continues to meet requirements and improve its QA program. TRIUMF added that they are committed to continuous improvement using metrics to assess performance, and using internal audits as a self-assessment tool to ensure the QA program remains up to date.
15. Based on its consideration of the presented information, the Commission concludes that TRIUMF has appropriate organization and management structures in place to adequately carry out the activities under the proposed licence.

Human Performance Management

16. Human performance management encompasses activities that enable effective human performance through the development and implementation of processes that ensure the licensee's staff have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties.
17. TRIUMF explained that its training programs are implemented within the Systematic Approach to Training (SAT) framework, and consist of Safety Training (Safety Orientation Training, Radiation Protection Training and Conventional Safety Training), Operator Training and Job-specific Training. CNSC staff reported that two inspections and numerous document reviews on TRIUMF's training programs were conducted during the licence period and CNSC staff found that TRIUMF has made good progress towards fully implementing a SAT in all operations areas.
18. CNSC staff reported that seven action notices pertaining to adherence to TRIUMF's previously established SAT procedures for certain operations groups, qualification of trainers, and performance of training needs analysis were issued to TRIUMF following a January 2011 inspection. TRIUMF stated that a Training Implementation Panel was created to oversee the work of the training task force and ensure a timely implementation of training requirements for all groups on site. CNSC staff reported having reviewed TRIUMF's Corrective Action Plan (CAP) for addressing the deficiencies identified during the inspection and found it to be acceptable.
19. CNSC staff reported that they performed a follow-up inspection during a multi-disciplinary compliance inspection in December 2011 to evaluate the ongoing implementation of TRIUMF's CAP. CNSC staff stated that five action notices were resolved and the remaining two are progressing satisfactorily.
20. The Commission requested further information regarding the remaining action notices which are considered to be "long term" tasks. CNSC staff explained that the two action notices pertain to updating and maintaining the training program at TRIUMF and that these actions should be closed by the end of 2012, as per TRIUMF's CAP. A representative from TRIUMF confirmed that they are on track for completing the actions by the end of 2012. CNSC staff added that they are satisfied with TRIUMF's progress to date and CNSC staff will continue to monitor their progress.
21. The Commission enquired about the number of employees at TRIUMF subject to the training requirements. A representative from TRIUMF responded that they have 350 full-time employees and a large number of students, visiting scientists and contractors who are subject to training. TRIUMF explained that they are currently creating training plans for employee training. TRIUMF added that contractors are subject to another training program (basic site safety orientation) which is already in place.

22. The Commission asked if fall protection training and fire extinguisher training is part of the individual training plans. A representative from TRIUMF responded that fall protection is captured in the individual training plans of employees required to be qualified as part of the conventional safety requirements. A representative from TRIUMF stated that fire extinguisher training is not currently captured in the individual training plan but is provided to facility staff. A representative from TRIUMF stated that they will look into its inclusion in the individual training plans.
23. In response to a question from the Commission regarding the structure of the training programs, a TRIUMF representative provided an explanation of the different programs and their delivery methods. The Commission also asked if the radiation protection program is the only program with an expiration date. A representative from TRIUMF responded that radiation protection training expires every five years. A representative from TRIUMF added that workers with valid radiation protection training are considered nuclear energy workers and that refresher radiation protection training is offered to workers with radiation protection training from other institutions.
24. Based on its consideration of the presented information, the Commission concludes that TRIUMF has appropriate programs in place and that current efforts related to human performance management provide a positive indication of TRIUMF's ability to adequately carry out the activities under the proposed licence.

Operating Performance

25. Operating performance includes operating policies, reporting and trending, and application of operating experience (root cause analysis and corrective actions) that enable the licensee's effective performance, as well as improvement plans and significant future activities.

Operating Performance

26. TRIUMF reported that a majority of root causes of incidents involve a deficiency with Standards Policies and Administrative Controls (SPAC), for which focused resources in training and communication of SPAC have been allocated and improvement of the existing Management System has been completed to prevent non-conformities and improve operating performance.
27. TRIUMF and CNSC staff reported that 15 incident reports were submitted to CNSC staff during the licensing period, none of which resulted in a radiation dose in excess of applicable dose limits to either staff or the general public, or in a significant release of radioactive material to the environment. CNSC staff reported that TRIUMF has completed its investigation, analysis and implementation of corrective actions for all but the three most recent reported events. CNSC staff added that remedial measures proposed by TRIUMF and found to be acceptable by CNSC staff were immediately implemented by TRIUMF following the incidents.

28. CNSC staff stated that TRIUMF has a strong core of expertise in accident investigation and root cause analysis, despite the weakness noted related to the consistency with which Non-conformance Reporting and Resolution process has been implemented.
29. During the licensing period, CNSC staff reported having performed 14 regulatory compliance inspections, including focused inspections relating to TRIUMF's quality management system and to the radiation protection, training, fire protection, environmental protection, transport packaging, emergency preparedness, and site security programs. CNSC staff stated that TRIUMF is cooperative with CNSC staff to address issues and concerns, and responds promptly to action items identified during inspections or desktop reviews of reports and documentation.
30. CNSC staff reported that one new action item and seven action notices from previous inspections were outstanding as of December 2011. CNSC staff stated being satisfied with the progression of the resolution of the action item and action notices.
31. The Commission enquired on the life of the facility. TRIUMF responded that, based on their anticipated projects and plans, TRIUMF will be operational for another 40 years, but that the lifetime is subject to change with the development of projects and future investments from the Government of Canada.

Improvement Plan and Significant Future Activities

32. TRIUMF explained that planning activities and site preparation for the new Advanced Rare Isotope Laboratory (ARIEL) at TRIUMF are well underway. CNSC staff stated that a licence for site preparation is not required for a Class II Nuclear Facility, but is required for the construction of the facility. CNSC staff also stated that TRIUMF has not yet applied for a construction licence but that two minor amendments to TRIUMF's Class IB accelerator operating licence were approved via the abridged hearing process during the current licence period to enable site preparation activities related to the future construction of ARIEL.

Conclusion on Operating Performance

33. Based on the above information, the Commission concludes that the operating performance at the facility provides a positive indication of TRIUMF's ability to carry out the activities under the proposed licence.

Safety Analysis and Physical Design

34. The Commission examined issues related to the program areas of Safety Analysis, Safety Issues and Design in order to assess the adequacy of the safety margins provided by the design of the facility.
35. TRIUMF reported having an ongoing maintenance and upgrade program in order to achieve a high level of safety systems reliability. TRIUMF stated that maintenance, calibration and testing of safety system devices, radiation monitors and radiation monitoring equipment is captured and conforms to the requirements of their standard operating procedure *TSOP-08 Calibration and Inspection*. In order to ensure the safe and optimal operation of TRIUMF accelerators, TRIUMF reported having completed numerous upgrades to their safety systems.
36. CNSC staff reported that four licence amendments related to accelerator facility design changes were approved during the licensing period and that TRIUMF did not request any additional changes to facility design or operating parameters as part of its application to renew the operating licence.
37. CNSC staff reported that past issues related to design control were evaluated during an inspection in 2010. CNSC staff found that TRIUMF has satisfactorily modified their standard operating procedure *TSOP-06 Engineering Design, Manufacture and Assembly* to incorporate improved processes to address planning, review and release of designs to deal with issues related to design control.
38. With regards to human factors, CNSC staff reported that there have not been major facility design projects requiring human factors engineering during the licence period but they will be explicitly considered during future design projects.
39. CNSC staff also reported that TRIUMF maintains Safety Analysis Reports (SAR) to document the hazards analyses and assessment of mitigation measures for the various accelerators in operation at the site. CNSC staff stated that operational limits which were included in Appendix B of the previous licence have been included in the Licence Conditions Handbook for the proposed licence.
40. On the basis of the information presented, the Commission concludes that the design of the accelerator laboratories is adequate for the operation period included in the proposed licence.

Fitness for Service

41. Fitness for service covers activities that are performed to ensure the systems, components and structures at TRIUMF continue to effectively fulfill their intended purpose. The activities include testing, calibration and maintenance of safety systems, and annual shutdown and maintenance of the 500MeV cyclotron.

42. CNSC staff reported that TRIUMF has a well-established ongoing maintenance, calibration and testing program to ensure a high level of system reliability and that TRIUMF tests all safety systems at least annually. CNSC staff stated that a summary of TRIUMF's safety systems tests and calibrations is included in their Annual Compliance Report. CNSC staff also reported that TRIUMF's main cyclotron is shutdown yearly to allow for any major maintenance, upgrades or repair work to ensure the continued safe operation of the cyclotron.
43. The Commission is satisfied that TRIUMF has acceptable programs in place to ensure the physical condition of the systems, components and structures. The Commission is also satisfied with TRIUMF's programs for the testing, calibration and maintenance of safety systems.

Radiation Protection

44. As part of its evaluation of the adequacy of the provisions for protecting the health and safety of persons, the Commission considered the past performance of TRIUMF in the area of radiation protection. The Commission also considered TRIUMF's program to ensure that both radiation doses to persons and contamination are monitored, controlled, and kept as low as reasonably achievable (ALARA), with social and economic factors taken into consideration.
45. With regards to dose control, TRIUMF stated that dose results are reported and reviewed against performance targets at quarterly safety management meetings. TRIUMF also stated that they have been striving to reducing doses since the mid 1990's with better dose planning for maintenance work and with upgrades that resulted in significant reduction in the cyclotron residual radiation fields.
46. CNSC staff reported that one directive and three action notices were issued to TRIUMF during a focused compliance inspection of TRIUMF's Radiation Protection program conducted in January 2008. CNSC staff stated that these were due to a lack of written notification of radiation dose levels to Nuclear Energy Workers (NEWs) and due to the implementation and tracking of refresher radiation protection training for TRIUMF staff. CNSC staff confirmed that the directive and all action notices have been satisfactorily addressed by TRIUMF and are now closed.

Personnel Dosimetry

47. CNSC staff explained TRIUMF's personnel dosimetry program, where direct reading dosimeters are required to be worn for any work that involves potential exposure to ionizing radiation, routine bioassays are required for workers who regularly handle Iodine-123 and Iodine-125 in excess of 100 mega Becquerel (MBq) per month and 1MBq per month respectively, and urine analysis are required for workers exposed to tritium.

48. CNSC staff stated that TRIUMF continues to effectively implement and maintain a personnel dosimetry program to monitor and record worker doses.

Worker Dose Control

49. CNSC staff reported that radiation doses to personnel have been below the regulatory limits from 2007 to 2011 and are being adequately controlled. CNSC staff stated that there were no reportable neutron doses and all internal doses due to radioiodine exposures were below 0.05mSv/year for nuclear energy workers (NEWs). CNSC staff added that all reported doses are below the regulatory limits of 50 mSv per year and 100 mSv/five years for NEWs and below the regulatory limit of 1mSv per year for non-NEWs.
50. TRIUMF stated that they do not anticipate an increase in the collective personnel dose with the eventual onset of operation of the Electron Linear Accelerator (e-Linac) and the ARIEL accelerator.
51. The Commission noticed that the maximum dose to non-NEW workers in 2008 was 0.94mSv, which is very close to the 1mSv/year regulatory dose limit, and asked what controls failed and how the issue has been addressed. A representative from TRIUMF explained that this dose of 0.94mSv was erroneously recorded by Landauer⁵ as a non-NEW dose when it was actually received by a NEW, and that the maximum non-NEW dose should read 0.6mSv. A TRIUMF representative further explained that this error was found only after the CMD had been published.

Contamination Control

52. CNSC staff reported that TRIUMF maintains and implements a residual radiation and contamination monitoring program effectively and TRIUMF continues to strive to maintain doses to staff as low as reasonably achievable (ALARA) by performing dose planning, dose mitigation and dose monitoring.

Conclusion on Radiation Protection

53. 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, TRIUMF will provide adequate protection to the health and safety of persons, the environment and national security.

⁵ Dosimetry services used by TRIUMF.

Conventional Health and Safety

54. Conventional health and safety covers the implementation of a program to manage workplace safety hazards. The conventional health and safety program is mandated by provincial statutes for all employers and employees to minimize risk to the health and safety of workers posed by conventional (non-radiological) hazards in the workplace. This program includes compliance with the applicable labour codes and conventional safety training.
55. TRIUMF stated that they use lost-time injury as their metric for monitoring performance for conventional health and safety. TRIUMF reported having maintained an injury lost-time rate at or below that for British Columbia universities apart for the year 2011 due to an incident involving a slip and fall from shielding blocks. TRIUMF added that the circumstances that led to the slip and fall incident have been analyzed and implementation of corrective actions is underway.
56. CNSC staff reported that TRIUMF maintains a documented workplace occupational health and safety (OH&S) program in accordance with WorkSafe B.C. regulations. CNSC staff also reported that TRIUMF has a well established training program for conventional health and safety and CNSC staff stated that they are satisfied with TRIUMF's performance in this safety and control area.
57. The Commission is of the opinion that the health and safety of workers and the public was adequately protected during the operation of the facility for the current licence period, and that the health and safety of persons will also be adequately protected during the continued operation of the facility.

Environmental Protection

58. Environmental protection covers TRIUMF's programs to identify, control and monitor all releases of nuclear substances and to minimize the effects on the environment which may result from the licensed activities. It includes effluent and emissions control, environmental monitoring, and estimated doses to the public.
59. TRIUMF presented a summary of their air activation emissions and their volatile and particulate emissions from the last 10 years which showed that air activation emissions are at 1% of the derived release limit (DRL)⁶. TRIUMF stated that air activation limits were 20% lower in 2010 due to the shortened operation time for the high current beam line. CNSC staff added that TRIUMF's atmospheric releases are normally less than 1% of the DRLs established under the licence since the atmospheric releases are dominated by very short lived isotopes. CNSC staff also stated that TRIUMF has holding tanks to

⁶ Derived Release Limit (DRL) is the theoretical quantity of a nuclear substance released in a year that would result in a committed effective radiation dose of 1mSv to the most exposed group of the public (also known as the critical receptor) for that nuclear substance.

control contaminated water where radioisotopes are allowed to decay before the water is released to the sanitary sewer and that TRIUMF maximizes the holding period in order to further reduce activity.

60. TRIUMF reported that their atmospheric transfer modelling for the DRL is conservative since data obtained from the Health Canada detector located on the top of the Forest Products Innovations building shows that the dose is lower by a factor of two to three than that obtained from measured emissions and the site DRL modelling. CNSC staff reported that TRIUMF's environmental samples are consistently at normal natural background levels and monitoring results show that the maximum potential dose to the public resulting from a typical year of TRIUMF operations is approximately 0.003mSv. CNSC staff added that the dose is completely attributable to the air activation products associated with the normal operation of the main cyclotron.
61. TRIUMF and CNSC staff reported that TRIUMF has begun the process of updating its DRL documents to comply with the requirements of *CAN/CSA-N288.1 2008*⁷, which should be completed by the end of 2012. CNSC staff said that TRIUMF maintains up-to-date DRLs in compliance with CNSC requirements, as stated in their operating licence.
62. The Commission asked if TRIUMF will be lowering their DRLs during the update of their documentation, given that the measured releases are two to three times lower than the site DRL modelling. A representative from TRIUMF responded that they will examine their modelling parameters since weather station data collected over the last two years indicate there is a lower frequency of wind blowing in the direction of TRIUMF's nearest population.
63. TRIUMF stated that they do not expect the future operation of the ARIEL facility to have an effect on existing site emissions due to the lower beam energy and the fact that ARIEL is an electron accelerator rather than a proton accelerator.
64. CNSC staff reported that a Type II compliance inspection was conducted in December 2007. CNSC staff stated having identified areas for improvement in effluent monitoring, environmental monitoring and waste management but that no significant issues of non-compliance were identified. CNSC staff added that TRIUMF has satisfactorily implemented improvements to its environmental protection program. CNSC staff also reported that TRIUMF is effectively maintaining and implementing their environmental protection program and controlling releases to the environment.
65. Based on the above information, the Commission is satisfied that, given the mitigation measures and safety programs that are in place to control hazards, TRIUMF will provide adequate protection to the health and safety of persons and the environment.

⁷ Canadian Standards Association N288.1-08 – Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities (2008).

Emergency Management and Fire Protection

66. Emergency management and fire protection covers the provisions for preparedness and response capabilities which exist for emergencies and for non-routine conditions at TRIUMF. This includes nuclear emergency management, conventional emergency response, and fire protection and response.

Fire Protection

67. TRIUMF reported that the TRIUMF Fire Protection Program (FPP) has been revised over the last three years. CNSC staff confirmed that the FPP is in compliance with the requirements of the *National Building Code of Canada (2005)*, the *National Fire Code of Canada (2005)*, and the National Fire Protection Association standard *NFPA-801: Standard for Fire Protection for Facilities Handling Radioactive Materials (2003)*. TRIUMF added that the FPP now meets the *National Fire Code of Canada's* requirements for inspection, testing and maintenance of fire protection systems.
68. TRIUMF also reported that they have completed the following since their last licence renewal in 2007: a site Fire Hazard Analysis; a site Pre-Incident Plan to provide emergency responders with a summary of hazards present in different areas; and an annual FPP third party review. TRIUMF stated that corrective actions have been implemented to address the deficiencies identified in these reviews.
69. CNSC staff reported that TRIUMF submitted its annual Third Party Reviews of fire protection provisions as required by the operating licence and some deficiencies were noted. CNSC staff stated that the deficiencies relate to record keeping and that TRIUMF is currently addressing them.
70. CNSC staff reported having conducted a fire protection inspection in August 2009 which resulted in three directives, four action notices and one recommendation being issued. CNSC staff confirmed that all directives and action notices were satisfactorily addressed.

Emergency Preparedness

71. TRIUMF stated that two site wide evacuation drills and a smaller scale compound exercise were conducted since 2007. TRIUMF also stated that CNSC staff were present to witness one of the evacuation drills and that a proper assessment of both drills and the exercise was conducted. Recommendations regarding signage and formalizing the communication protocol used during the emergency have been implemented. TRIUMF reported that emergency preparedness will be coordinated with the ARIEL contractor and that a site-wide evacuation drill will be conducted in June 2012. CNSC staff is planning on performing an inspection of this upcoming drill.

72. CNSC staff confirmed that one emergency program inspection of an evacuation drill was completed during the licensing period. CNSC staff did not issue action notices or directives and found the drill to be acceptable.
73. The Commission enquired about the periodicity of site-wide evacuation drills. TRIUMF responded that site-wide evacuation drills are conducted every two years. CNSC added that they are satisfied with the periodicity of these drills.
74. CNSC staff reported that TRIUMF maintains an emergency program in accordance with CNSC regulatory requirements and that off-site radiological emergency risks associated with TRIUMF's operation are very low.
75. CNSC staff stated that they also conducted an emergency preparedness inspection in April 2009 which was found to be acceptable and no action notices or directives were issued.
76. CNSC staff reported that TRIUMF submitted their analysis regarding natural disasters in May 2011 in response to the CNSC information request regarding lessons learned from the Fukushima accident. CNSC staff stated that an accident of the type which occurred at Fukushima is not possible at TRIUMF due to the fundamental differences in design and operation. CNSC staff reported that no changes to TRIUMF's facilities, safety systems, programs or operating procedures were required.
77. The Commission asked for more information regarding TRIUMF's response to the Fukushima accident. A TRIUMF representative explained that they have gone through different disaster scenarios and they have emergency response procedures that would allow them to respond to and handle different emergencies, whether fire, earthquake or personal injury. The TRIUMF representative further explained that if an earthquake were to occur, the accelerators would simply turn off as soon as there is a loss of power, which removes the radiation risk immediately. A TRIUMF representative also stated that they have carefully analyzed potential escape routes for gaseous radioactive effluent from their vacuum system and have installed additional monitoring on the effluent systems to ensure they have appropriate alarming capabilities to alert when an evacuation from a specific area is required⁸. CNSC staff confirmed that TRIUMF has appropriate mitigation measures in place and appropriate short-term actions that will prevent potential events. CNSC staff explained that if containment was lost, the environmental impact would be minimal or nonexistent due to the short half-life of radio-isotopes at the TRIUMF facilities.

⁸ CNSC staff provided additional information after the hearing clarifying that an analysis of the worst case releases following a disaster similar to Fukushima or worse was submitted by the licensee, and reviewed and accepted by CNSC staff. This analysis shows that even in the event of a complete loss of all gaseous and volatile inventories, the releases would be well below any level requiring any intervention for the surrounding community and no worker on the site would receive exposures approaching regulatory limits.

Conclusion on Emergency Management and Fire Protection

78. Based on the above information, the Commission concludes that the fire protection measures and emergency management preparedness programs currently in place, and that will be in place, at the facility are adequate to protect the health and safety of persons and the environment.

Waste Management

79. Waste management covers the licensee's site-wide waste management program. CNSC staff evaluated TRIUMF's performance with regards to waste minimization, segregation, characterization, and storage.
80. TRIUMF explained their waste management processes for high and low level radioactive waste and stated that shipment of wastes to licensed waste management facilities is reported in their Annual Compliance Report. CNSC staff noted that both the radioactive waste management program and the waste management program for non-hazardous waste require updating to reflect the most current revision of the *Nuclear Substances and Radiation Devices Regulations* and to include additional information on hazardous waste disposal methods. CNSC staff stated that updating program documentation will be addressed during a focused inspection of TRIUMF's waste management program which is planned for 2012.
81. CNSC staff reported having examined various aspects of waste management during several general compliance inspections at TRIUMF. CNSC staff reported that there were no issues related to handling, storage and disposal of higher activity waste. CNSC staff further reported that issues related to handling and disposal of low level radioactive waste (LLRW) were identified, such as the lack of timely transfer of LLRW bags from operational areas to designated storage locations. CNSC staff stated that, during an inspection held in July 2011, a backlog of waste which was due to repeated failures of a newly acquired detector used to assaying waste prior to disposal and a delay in the installation of two new LLRW storage facilities on site were noted. CNSC staff stated that corrective actions were issued and TRIUMF has satisfactorily addressed these issues in a prompt manner.
82. The Commission asked why it took a long period of time to address the waste management issues, which had been raised numerous times in the past. TRIUMF explained that the delays of the repeated findings deal essentially with their janitorial support staff for their radiation areas (have had higher turnover in terms of personnel in that group that has led to some of the delays). They now have procedures in place to address the janitorial support that is required for those radiation areas.

83. TRIUMF reported having recently upgraded the waste characterization equipment to be able to demonstrate compliance with the CNSC Clearance Levels. Waste characterization procedures are being updated and will be submitted to the CNSC for review. CNSC staff added that the procedures will be updated to utilize the clearance levels and quantities described in CSA standard *N292.5-11*⁹ and will be reviewed by CNSC staff for approval.
84. The Commission enquired about the high level radioactive waste produced at TRIUMF. A representative from TRIUMF explained that their production facilities generate approximately 10 irradiated targets of waste annually, with an activity per target of two to three curies. The Commission asked what volume of high level radioactive waste is transported in one shipment and where the waste is shipped to. The representative from TRIUMF explained that a spent target, which includes 50 grams of material and the associated hardware, the cooling and the ion source, take up a volume of approximately 50 gallons and are shipped to Atomic Energy of Canada Limited in Chalk River in a shielded flask. The representative from TRIUMF added that they ship approximately 10 of these containers annually.
85. Based on the above information and considerations, the Commission is satisfied that TRIUMF is safely managing waste at its accelerator facilities.

Security

86. With respect to site security issues, the Commission was provided with a separate, protected CMD, which was considered in a closed session.
87. The Commission is satisfied that TRIUMF's performance with respect to maintaining security at the facility has been acceptable.
88. The Commission concludes that TRIUMF has made adequate provisions for ensuring the physical security of the facility, and is of the opinion that TRIUMF will continue to make adequate provisions during the proposed licence period.

Safeguards

89. 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 in peaceful, non-explosive uses and that there is no undeclared nuclear material or activities in this country.

⁹ Canadian Standards Association N292.5-11: Guideline for the exemption or clearance from regulatory control of materials that contain, or potentially contain, nuclear substances (2011)

90. TRIUMF stated that it continues to participate in the IAEA Integrated Safeguards Approach. TRIUMF also stated that they continue to file a monthly general ledger for the inventory of fissile and fertile substances. TRIUMF stated that it does not foresee any changes in the Safeguards program for the next licensing period.
91. TRIUMF reported that it was found to be compliant during an IAEA Safeguards inspection carried out in October 2008. CNSC staff stated that they did not participate in this IAEA inspection which comprised a Physical Inventory Verification, combined with a Design Information Verification and a Complementary Access.
92. The Commission asked if the CNSC is notified of IAEA inspections and if they participate in IAEA inspections. CNSC staff responded that they get advanced notice from the IAEA when they are to conduct an inspection at a Canadian facility and that they make all efforts to attend all IAEA inspections to the extent possible, but that they apply a risk-based approach depending on availability of personnel. The Commission asked if CNSC staff is copied on results from IAEA inspections, regardless of whether CNSC staff attend the inspection or not. CNSC staff responded that the IAEA is required to provide written results of any inspection conducted by the IAEA in Canada as part of the Safeguards Agreement with the IAEA.
93. The Commission enquired about the frequency of IAEA inspections at TRIUMF. CNSC staff explained that the IAEA has recently adopted a risk-based randomized approach to conducting inspections at Canadian nuclear facilities and that since TRIUMF is considered a very low risk facility for safeguards, IAEA inspections are carried out, on average, once every five to seven years.
94. CNSC staff stated that the accounting and reporting of nuclear material at TRIUMF in support of safeguards will continue to be governed by CNSC document RD-336: *Accounting and Reporting of Nuclear Materials*. CNSC staff reported that TRIUMF provided the CNSC with all reports and information necessary for safeguards and complied with IAEA and CNSC requirements. CNSC staff also reported having reviewed TRIUMF's submission and inspection results and concluded that TRIUMF has satisfied the safeguards requirement specified in the operating licence.
95. Based on the above information, the Commission is satisfied that TRIUMF has made and will continue to make adequate provisions in the areas of safeguards and non-proliferation at the accelerator laboratories that are necessary for maintaining national security and measures necessary for implementing international agreements to which Canada has agreed.

Packaging and Transport

96. Packaging and transport covers the safe packaging and transport of nuclear substances to and from TRIUMF. TRIUMF must adhere to the *Packaging and Transport of Nuclear Substances Regulations*¹⁰ and Transport Canada's *Transportation of Dangerous Goods Regulations*¹¹ 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.
97. CNSC staff stated that TRIUMF is required to have appropriate training for personnel involved in the handling of nuclear substances for the packaging and transport, as per the *Transportation of Dangerous Goods Regulations*. TRIUMF and CNSC staff both confirmed that personnel handling radioactive materials for these purposes have received the required *Transportation of Dangerous Goods Regulations* training, as identified in their Individual Training Plans.
98. TRIUMF reported having revised their Emergency Response Plan for transport of low-level waste. TRIUMF noted that Transport Canada recently accepted the revisions made to this plan. CNSC staff stated that a Type II packaging and transport specific inspection performed in December 2011 did not find any non-compliances or safety issues related to the packaging and transport of nuclear substances by TRIUMF. CNSC staff also reported that there were no packaging and transport related incidents during the current licence period.
99. The Commission noticed that the only CNSC compliance inspection focusing on the safety and control area of transportation and packaging (Type I inspection) was performed at the end of the licensing period. The Commission asked if this safety and control area was assessed earlier on during the licensing period and, if not, how CNSC staff assured that TRIUMF was compliant throughout the licensing period. CNSC staff responded that their bi-annual compliance inspections did not reveal a need for a focused transportation and packaging program inspection earlier than its scheduled inspection in December 2011.
100. Base on the above information, the Commission is satisfied that TRIUMF is meeting regulatory requirements regarding packaging and transport.

¹⁰ SOR/2000-208

¹¹ SOR/2001-286

Application of the *Canadian Environmental Assessment Act*

101. Before making a licensing decision, the Commission must be satisfied that all applicable requirements of the *Canadian Environmental Assessment Act*¹² (CEAA) have been fulfilled.
102. As part of TRIUMF's licence renewal, CNSC staff are proposing a number of changes to the licence. The renewal of a licence with changes is interpreted as an amendment. CNSC staff indicated that although an amendment of a licence under subsection 24(2) of the NSCA is listed as a 'trigger' under the *Law List Regulations*¹³ of the CEAA, the proposed changes to the licence are all administrative in nature; therefore there are no physical works or undertakings relating to physical works for this licence renewal, and as such, there is no 'project' pursuant to section 2 of the CEAA. Since there are no other CEAA triggers for this project that involve the CNSC, CNSC staff stated that an environmental assessment under CEAA is not required.
103. The Commission is satisfied that an environmental assessment under the CEAA is not required for TRIUMF's application for licence renewal.

Aboriginal Consultation and Public Information Program

Aboriginal Consultation

104. The common law duty to consult with Aboriginal groups applies when the Crown contemplates actions that may adversely affect established or potential Aboriginal or treaty rights. The CNSC ensures that all its licensing decisions under the NSCA uphold the honour of the Crown and consider Aboriginal peoples' potential or established Aboriginal or treaty rights pursuant to section 35 of the *Constitution Act, 1982*¹⁴.
105. CNSC staff reported having determined that the activities to be regulated under the proposed licence will not cause adverse impacts on potential or established Aboriginal or treaty rights.

Public Information Program

106. A public information program is a regulatory requirement for licence applicants and licensed operators of Class I nuclear facilities, such as accelerator laboratories. Paragraph 3(j) of the *Class I Nuclear Facilities Regulations*¹⁵ 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.*"

¹² S.C. 1992, c. 37

¹³ SOR/94-636.

¹⁴ *The Constitution Act*, being Schedule B to the Canada Act 1982 (U.K.), 1982, c. 11.

¹⁵ SOR/2000-204

107. TRIUMF reported that it has been working to enhance relation with the local community. TRIUMF stated that they have a Strategic Planning and Communications Officer who has undertaken several initiatives to connect with and invite the local community to the laboratory. TRIUMF and CNSC staff added that TRIUMF is currently considering developing a formal framework for regular public participation in the laboratory with the aim to establish a mechanism for evaluating the important issues facing TRIUMF and the community and to provide a forum for communications.
108. TRIUMF explained that, under the terms and conditions of its lease with the University of British Columbia, TRIUMF must hold an Open House for all new construction projects where all members of the community are invited to attend and become informed on any aspect of the project. TRIUMF stated that an Open House for the ARIEL project was held at TRIUMF on June 16, 2011.
109. TRIUMF reported that it will continue to explore ways of engaging all community stakeholders and sharing information on TRIUMF's operation. CNSC staff reported that they find TRIUMF's existing public information program to be adequate.
110. The Commission requested further information regarding TRIUMF's plan for regular public participation in the laboratory. TRIUMF explained that in order to reach out to the growing community, they are planning to hire a third party consultant who would perform outreach to the community to determine what concerns the residents may have in order to determine if TRIUMF's existing outreach activities are sufficient.

Conclusion on Aboriginal Consultation and Public Information Program

111. Based on the above information, the Commission is satisfied that TRIUMF's public information program meets regulatory requirements and is effective in keeping the public informed on the facility operations. The Commission also acknowledges the efforts made in relation to the CNSC's obligations regarding Aboriginal consultation and the Legal Duty to Consult.

Decommissioning Plans and Financial Guarantees

112. The Commission requires that the licensee has operational plans for decommissioning and long-term management of waste produced during the life-span of the facility. In order to ensure that adequate resources are available for a safe and secure future decommissioning of TRIUMF's facilities, 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.

Decommissioning Plan

113. CNSC staff stated that licensees are required to maintain an acceptable decommissioning plan that sets out the manner by which the nuclear facility will be decommissioned in the future. The decommissioning plan must be kept current to reflect any changes in the site or facility, and meet the requirements of CSA standard *N294-09*¹⁶ and the guidance of CNSC Regulatory Guide *G-219*¹⁷. TRIUMF stated that their preliminary decommissioning plan (DP) addressed the activities that will need to be undertaken for a full decommissioning of the facility to a greenfield site. TRIUMF provided an overview of the planned decommissioning phases. CNSC staff reported having reviewed TRIUMF's DP in 2007 and found it to be satisfactory.
114. CNSC staff stated that TRIUMF is currently in the process of revising the DP to include projected costs for the new ARIEL Class II acceleratory facility which will eventually be incorporated under the licence, and to include provisions for removal of ancillary buildings. CNSC staff added that the revisions will also update the cost estimate from 2007 to 2011 dollars. CNSC staff reported that they will assess the revised DP against the requirements of CSA standard *N294-09* and CNSC Regulatory Guide *G-219* as part of the assessment of the licence application for the new ARIEL facility.

Financial Guarantees

115. Both CNSC staff and TRIUMF reported that the financial guarantee, which is composed of the Financial Security and Access Agreement, the Escrow Agreement and the Fund Contribution Gap Agreement¹⁸, has a cash balance of \$10.1 million as of March 31, 2011. CNSC staff and TRIUMF also confirmed that the cost of decommissioning is currently estimated as \$44.2 million (in 2011 dollars). TRIUMF stated that there are sufficient funds available to finance to costs associated with the initial phase of decommissioning (\$9.9 million) and that the balance of decommissioning activities will be fully funded by the growth of the decommissioning fund via proceeds from the sales of assets at shutdown and investment income generated.
116. CNSC staff stated that TRIUMF must submit annual reports on the status of the financial guarantees and the status of the funds in order to demonstrate compliance with this commitment. CNSC staff reported that TRIUMF has complied with this commitment. CNSC staff stated that, once they review the revised DP, they will evaluate the need for corresponding changes to the financial guarantee and that the revised financial guarantee will be submitted to the Commission for acceptance.

¹⁶ *N294: Decommissioning of Facilities Containing Nuclear Substances*, Canadian Standards Association, 2009.

¹⁷ CNSC Regulatory Guide *G-219, Decommissioning planning for Licensed Activities*, 2000

¹⁸ CNSC document number 3092829

117. The Commission enquired about the initial phase of decommissioning for which a financial guarantee of \$9.9 million has been allocated. TRIUMF explained that the initial phase of decommissioning will comprise of the removal of buildings that can be dismantled immediately following the decision to cease operation and following the secured shutdown state of the facility.
118. With regards to the proceeds that will be generated from the sale of assets, the Commission asked if TRIUMF can guarantee that the sell of their assets will provide sufficient funds to complete their decommissioning activities. CNSC staff explained that they do not expect the sale of assets alone to cover the entire decommissioning costs. CNSC staff stated that TRIUMF currently has enough funds for the safe storage with surveillance of their facility. CNSC staff also stated that the money generated from the sale of assets will be invested and the growth of this investment should provide sufficient funds to decommission the facility. CNSC staff added that if there is a shortfall between the growth of the fund and the final decommissioning cost, the Fund Contribution Gap Agreement states that full member universities will supplement the funding to ensure the full cost for decommissioning.

Conclusion on Decommissioning Plans and Financial Guarantees

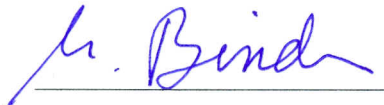
119. Based on this information, the Commission considers that the decommissioning plan and related financial guarantee are acceptable for the purpose of the current application for licence renewal.

Licence Length and Conditions

120. TRIUMF has applied to the Commission for a ten-year licence. CNSC staff reported that the current licence was issued to TRIUMF for a five-year term. CNSC staff confirmed that TRIUMF has met the criteria for a licence term longer than five years and that the requested longer licensing period will have no adverse impact on the management and operation of TRIUMF.
121. Based on the information received during the course of this hearing, the Commission is satisfied that a 10-year licence with annual industry reports on the performance of TRIUMF, as part of the annual report on the safety performance of nuclear substances in Canada, 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 as described in the draft Licence Conditions Handbook (LCH) attached to CMD 12-H5. The Commission notes that CNSC staff can bring any matter to the Commission as applicable.

CONCLUSION

122. The Commission has considered the information and submissions of CNSC staff and the applicant as set out in the material available for reference on the record.
123. 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.
124. The Commission is satisfied that the applicant meets the requirements of subsection 24(4) of the *Nuclear Safety and Control Act*. That is, the Commission is of the opinion that the applicant is qualified to carry on the activity that the proposed licence will authorize and that the applicant 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.
125. Therefore, the Commission, pursuant to section 24 of the *Nuclear Safety and Control Act*, renews TRIUMF Accelerators Inc.'s Class IB Particle Accelerator Operating Licence for its accelerator laboratories located on the University of British Columbia's campus in Vancouver, British Columbia. The renewed licence, PA1OL-01.00/2022, is valid from July 1, 2012 to June 30, 2022.
126. The Commission includes in the licence the conditions as recommended by CNSC staff and set out in the draft licence attached to CMD 12-H5. The Commission also accepts CNSC staff's recommendation regarding the delegation of authority, as described in the draft 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.
127. With this decision, the Commission directs CNSC staff to provide an annual report on the performance of TRIUMF, as part of the annual report on the safety performance of nuclear substances in Canada. CNSC staff shall present these reports at public proceedings of the Commission.



Michael Binder
President,
Canadian Nuclear Safety Commission

JUN 28 2012

Date