Regulatory Oversight Report for Research Reactors and Class IB Accelerators: 2016 – 2017

Commission Meeting
August 22-23, 2018
CMD 18-M32.A

Staff Presentation

e-Doc 5568257 PPTX
e-Doc 5610129 PDF

Report Format

Part 1: Research Reactors

- McMaster Nuclear Reactor
- Royal Military College of Canada SLOWPOKE-2
- University of Alberta SLOWPOKE-2
- Saskatchewan Research Council SLOWPOKE-2
- École Polytechnique de Montréal SLOWPOKE-2

Part 2: Class IB Accelerators

- TRIUMF
- Canadian Light Source Inc.

Scope

- Calendar years 2016 and 2017
- Last ROR for these facilities was for 2015 (CMD 16-M43)
- Highlights CNSC staff's regulatory compliance efforts
- Provides a performance summary on all 14 Safety & Control Areas
- Focus on:
  - Radiation Protection
  - Environmental Protection
  - Conventional Health and Safety

Public Consultation

- April 3, 2018 – Notice of Participation at a Commission Meeting and Participant Funding Offered
- CMD was made available for public comments on June 22, 2018
- No interventions received
- One application for Participant Funding Program, but later withdrawn
- ROR is one of the pillars used by the CNSC to disseminate information

Regulating the Nuclear Sector (1/2)

- The CNSC regulates the nuclear sector in Canada:
  - protect the health, safety and security of Canadians and the environment
  - implement Canada's international commitments on the peaceful use of nuclear energy
  - disseminate objective scientific, technical and regulatory information to the public
- Reduce risk to people and the environment from nuclear activities and facilities

Regulating the Nuclear Sector (2/2)

CNSC regulates nuclear facilities based on:

- the provisions of the *Nuclear Safety and Control Act* (NSCA)
- the regulations under the NSCA
- the licences
- Regulatory Documents
- licensee documentation

Errata in CMD 18-M32

- Page 14: NPROL-18.01/2023 [3] was issued for the period ending on June 30, 2023 instead of June 23, 2013
- Page 55: Section 3.9 made reference to contributions to a NRRR fund, which is not the case for Class IB facilities. Class IB facilities use letters of credit as Financial Guarantee instruments

Part 1

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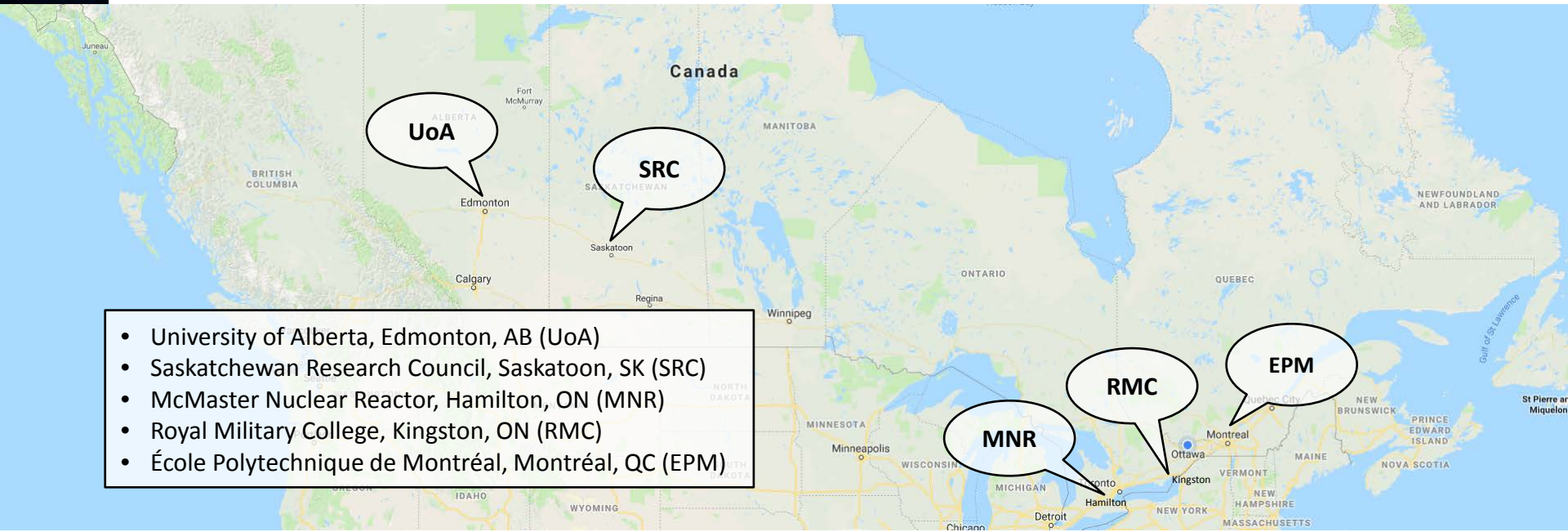
RESEARCH REACTORS

Research Reactor Locations

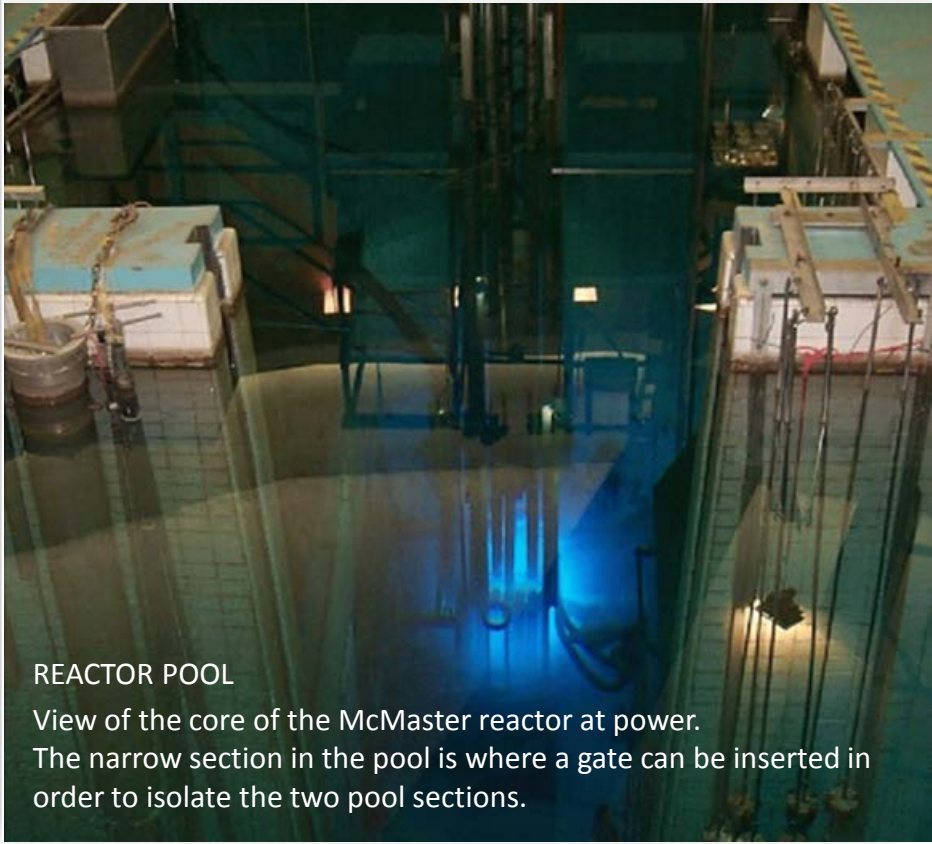


- University of Alberta, Edmonton, AB (UoA)
- Saskatchewan Research Council, Saskatoon, SK (SRC)
- McMaster Nuclear Reactor, Hamilton, ON (MNR)
- Royal Military College, Kingston, ON (RMC)
- École Polytechnique de Montréal, Montréal, QC (EPM)

Research Reactors

- Low power
- Ambient temperature and pressure
- Light water
- Safety features
  - SLOWPOKES are self-limiting in power
  - MNR has a containment building
- Low environmental footprint
  - No liquid radiological releases
  - Dose to the public ≈ 1 µSv/yr

Very Low Risk



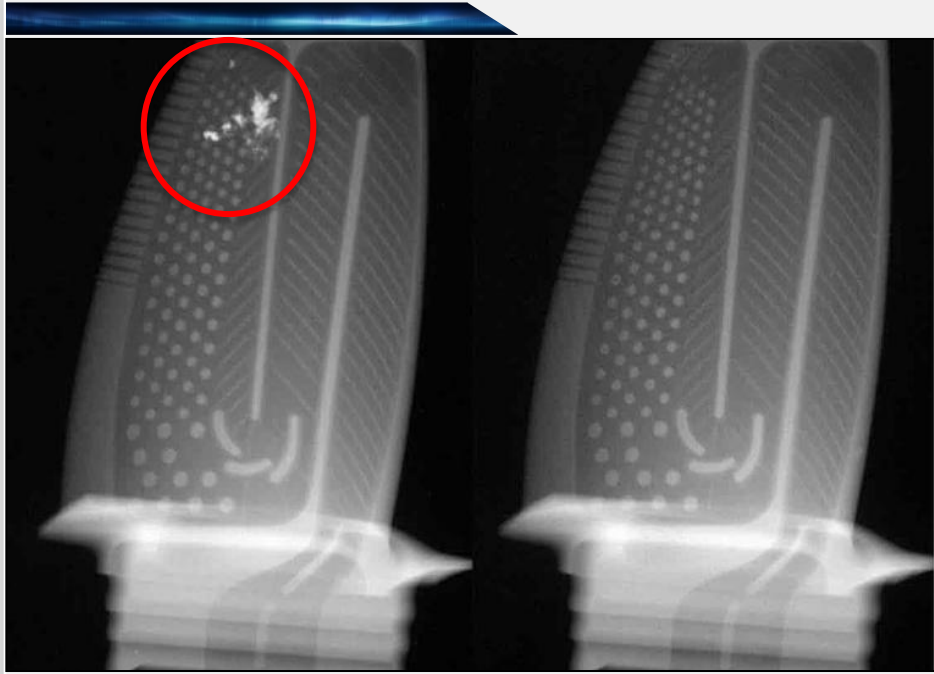
REACTOR POOL

View of the core of the McMaster reactor at power.
The narrow section in the pool is where a gate can be inserted in order to isolate the two pool sections.

McMaster Nuclear Reactor

MNR is a 5 MW research reactor located on the campus of McMaster University in Hamilton

- Commissioned in 1959
- Licence NPROL-01.00/2024 was issued by the Commission in 2014 for a period of 10 years
- Medical isotopes – Iodine-125
- Neutron radiography
- Research



Picture shows two turbine blades exposed to neutron radiography at MNR. The blade on the left shows material from the molding process left in the cooling channels.

Photo: Applus+ website.

Royal Military College of Canada (1/2)

- Royal Military College of Canada operate a SLOWPOKE-2 reactor on the campus in Kingston, ON
- Commissioned in 1985
- Licence NPROL-20.00/2023 issued in 2013 for 10 years
- Neutron activation analysis
- Neutron radiography
- Research and education

In this picture, we can see the Royal Military College in Kingston, Ontario. The SLOWPOKE reactor is located in the Sawyer Science and Engineering Building, identified by the circle.

Royal Military College of Canada (2/2)

- Refueling of RMCC, starting in April 2019
- 32 years of operation with original core
- CNSC staff will increase compliance oversight during project
  - Licence to transport and export core
  - Commissioning of the new core
- Completion: 2021

SLOWPOKE 2 CORE

Actual size model of a SLOWPOKE core. The core is about 30 cm in diameter. The fuel core is contained inside of a vessel full of water which is submerged in a pool of water, which shields radiation and dissipates the heat. We can see the beryllium plates on top of the core, known as shims, which are used as a neutron reflectors and serve to adjust the reactivity of the core. Photo: RMCC

University of Alberta (1/2)

- University of Alberta SLOWPOKE-2 reactor was located on the campus of University of Alberta in Edmonton, Alberta
- Operated between 1977 and 2017
- Facility was decommissioned in 2017
  - Core removed repatriated to the U.S. July 2017
  - All components removed
  - Pool water purified, drained
  - No contamination

Loading of the shielded reactor core in preparation for shipping it to the United States.
Photo: University of Alberta

University of Alberta (2/2)

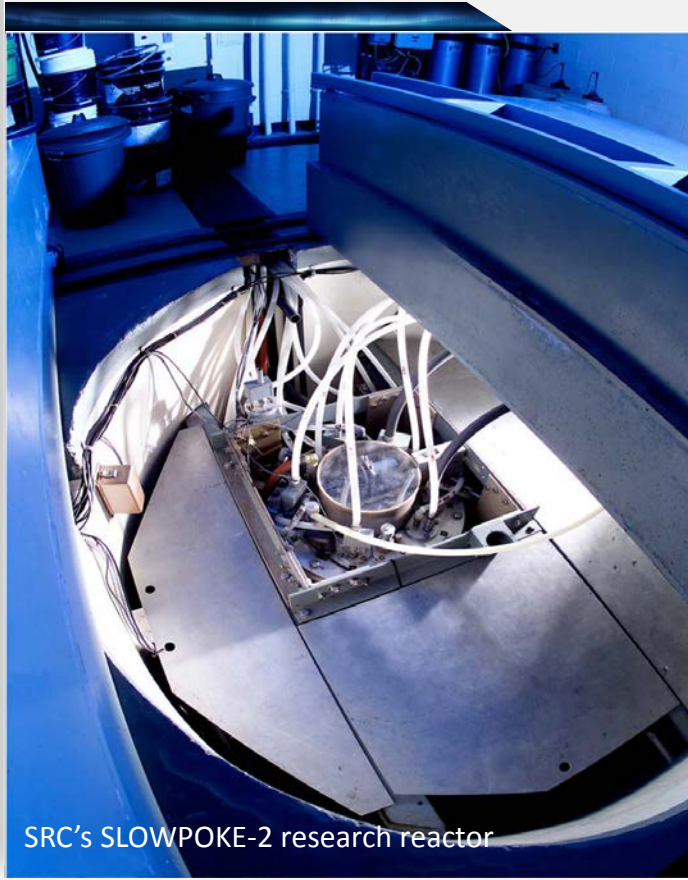
- CNSC staff inspected the facility after decommissioning
  - Facility was confirmed clean - no contamination
- CNSC staff reviewed end-state report, including radiological survey data for all components
- Commission revoked operating licence NPROL-18.01/2023 on May 25, 2018

End-State: The facility can be repurposed for any non-nuclear activities without any restrictions

Commissioned in April 1977, the University of Alberta's Safe Low Power Kritical Experiment (SLOWPOKE) Nuclear Reactor Facility was a low-power reactor used to support research, teaching and industry. The reactor was located on the U of A main campus until the end of July 2017; the decommissioning was officially completed in June 2018.

Saskatchewan Research Council (1/2)

- SRC operates a SLOWPOKE-2 reactor in Saskatoon, SK
- Licence NPROL-19.00/2023 was issued by the CNSC in 2013 for a period of 10 years
- Commissioned in 1981
- Fueled with HEU
- Reactor uses include:
  - Research
  - Neutron activation analysis
  - Teaching with University of Saskatchewan



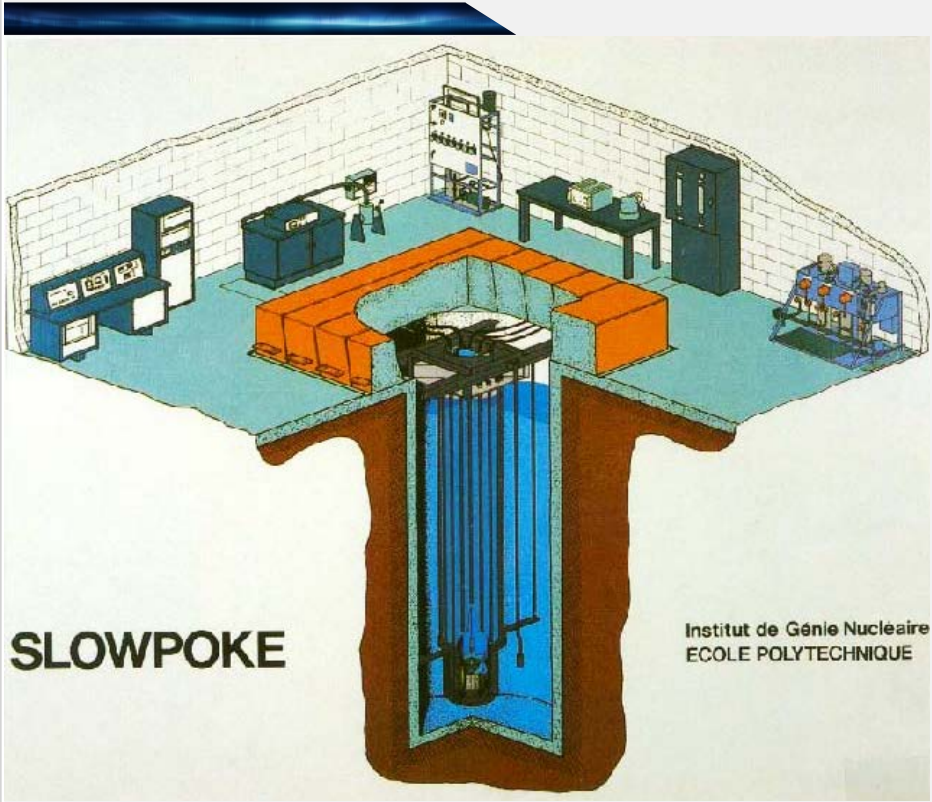
SRC's SLOWPOKE-2 research reactor

Saskatchewan Research Council (2/2)

- SRC announced in 2017 it will cease operations
- HEU core will be repatriated to the U.S. by end of 2019 under legal agreements
- Next steps:
  - Application to amend the licence (Nov. 2018)
  - Application for transport & export licences (2019)
  - Inspection to verify the end-state (2019)
  - Application for licence to abandon (2020)

École Polytechnique de Montréal (1/2)

- ÉPM exploite un réacteur SLOWPOKE-2 sur le campus de l'Université de Montréal
- Exploitation depuis 1976
- Permis PERFP-9A.01/2023 émis par la CCSN en 2016 pour une durée de 7 ans
- Réacteur est utilisé pour :
  - Recherche
  - Enseignement
  - Analyse neutronique



Schématisée du réacteur SLOWPOKE d'École Polytechnique.

École Polytechnique de Montréal (2/2)

- ÉPM exploite aussi un Assemblage Sous-Critique
- Permis consolidé avec celui du SLOWPOKE-2 en 2016
- Utilisé pour fins éducatives
- Dernière exploitation de l'Assemblage Sous-Critique remonte à 2012

Part 1

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PERFORMANCE AND REGULATORY OVERSIGHT

Performance Ratings for Research Reactors 2016 – 2017

FS: Fully Satisfactory
SA: Satisfactory
BE: Below expectations
UA: Unacceptable

Explanation of rating methodology in annex of this presentation

Safety and control area	MNR	U of A	SRC	RMCC	ÉPM
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	FS	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Reported Events – SLOWPOKE (2016-2017)

No events or operational challenges at the SLOWPOKES

- No radiation exposures
- No unauthorized releases to the environment
- The SLOWPOKES operated within their Operating Limits and Conditions

Reported Events – MNR (2016-2017)

- July 2016: There was a fire at a McMaster University service building in the vicinity of the reactor building. The reactor was not affected by the fire
- July 2017: MNR was started up with the Fission Products Monitor (FPM) offline for approximately 10 minutes. This was in contravention of the Operating Limits and Conditions

No safety consequences as a result of these incidents

Regulatory Compliance

- Risk-informed approach
  - Risk of the facility
  - Operational performance
  - Compliance history
  - Changes in operations
  - Changes in regulatory framework
- 10-year baseline inspection plans
- Annual compliance verification plans

CNSC staff conduct ongoing compliance verification

Regulatory Effort for Research Reactors in 2016 – 2017

Facility	2016			2017		
	Inspections	Licensing (person-days)	Compliance (person-days)	Inspections	Licensing (person-days)	Compliance (person-days)
McMaster Nuclear Reactor	1	57	118	1	56	110
University of Alberta	1	32	49	1	73	16
Saskatchewan Research Council	1	13	78	1	7	24
Royal Military College of Canada	1	42	60	1	10	23
École Polytechnique de Montréal	0	19	19	1	16	14
Totals	**4**	**163**	**324**	**5**	**162**	**187**

Radiation Protection SCA

This SCA encompasses the following specific areas:

- Application of ALARA
- Worker Dose Control
- Radiation Protection Program Performance
- Radiological Hazard Control
- Estimated Dose to the Public

All research reactor facilities were rated Satisfactory for this SCA

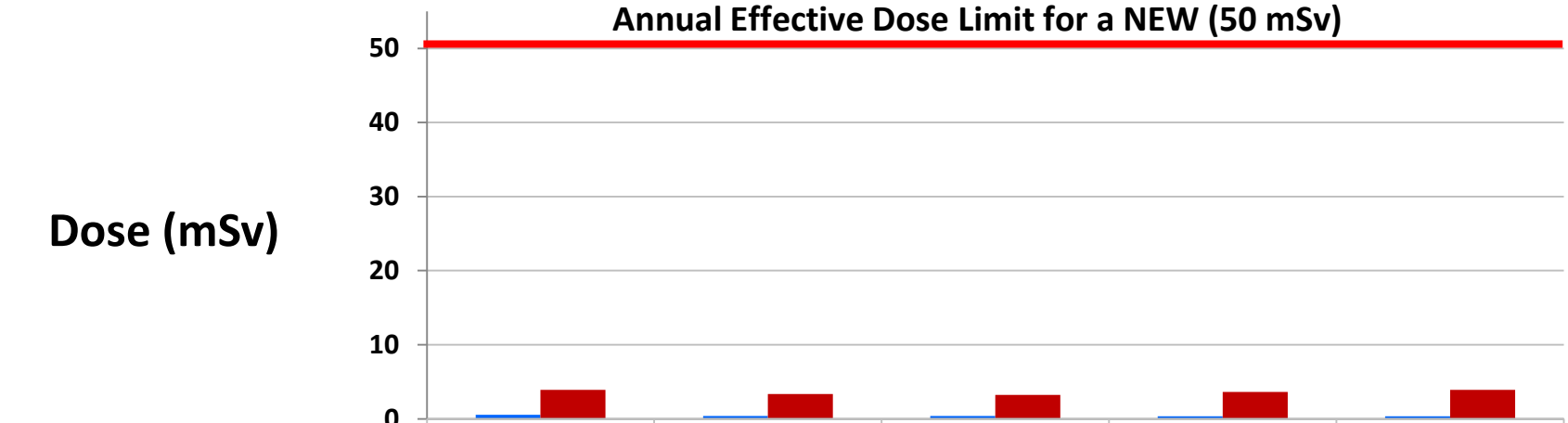
Radiation Protection

Effective Annual Dose to Workers 2016 – 2017

Dose Statistics	Non-NEWs			NEWs		
	SRC	ÉPM	RMCC	MNR	U of A	RMCC
Average effective dose (mSv)	<0.1	<0.1	<0.1	0.34	<0.1	<0.1
Maximum individual effective dose (mSv)	0.28	0.23	<0.1	3.91	<0.1	0.37
Total persons monitored (typical)*	17	7	8	111	2	19
Regulatory dose limit	**1 mSv**			**50 mSv**		

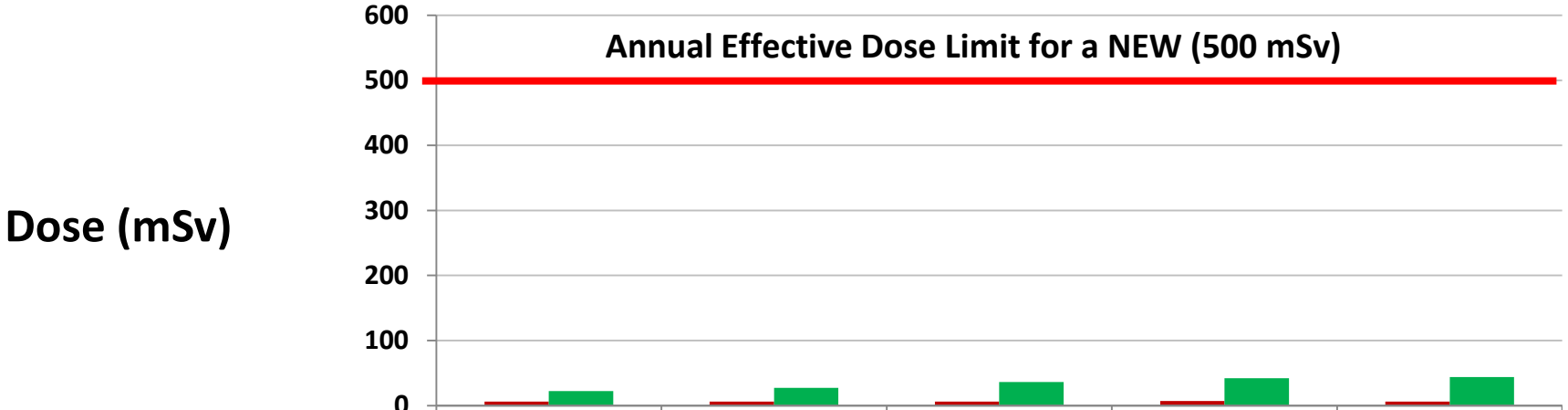
Notes: Number of persons can vary slightly from year to year. RMCC has NEWs and non-NEWS

Radiation Protection (MNR 5-year trend)



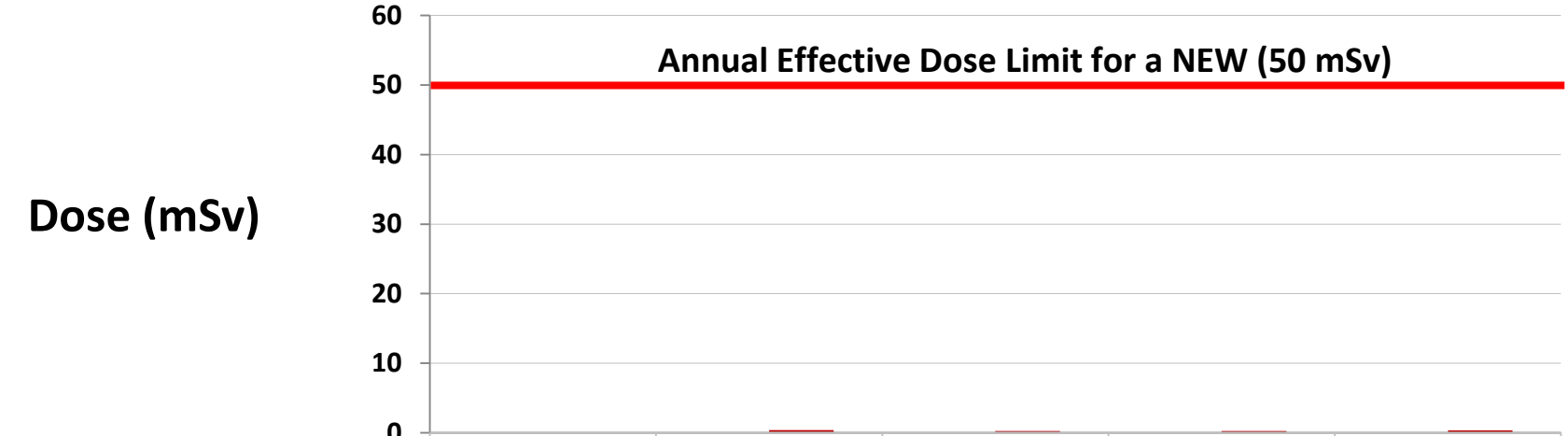
	2013	2014	2015	2016	2017
Average effective dose (mSv)	0.54	0.39	0.38	0.36	0.34
Maximum effective dose (mSv)	3.93	3.34	3.22	3.64	3.91

Radiation Protection (MNR extremity 5-year trend)



	2013	2014	2015	2016	2017
Average Equivalent Dose (mSv)	5.9	5.9	6.2	6.9	6.2
Maximum individual equivalent dose (mSv)	22.5	27.3	36.4	42.0	44.0

Radiation Protection (SLOWPOKE 5-year trend)



	2013	2014	2015	2016	2017
Average effective dose (mSv)	0	0.03	0.02	0.05	0.05
Maximum effective dose (mSv)	0	0.42	0.29	0.29	0.37

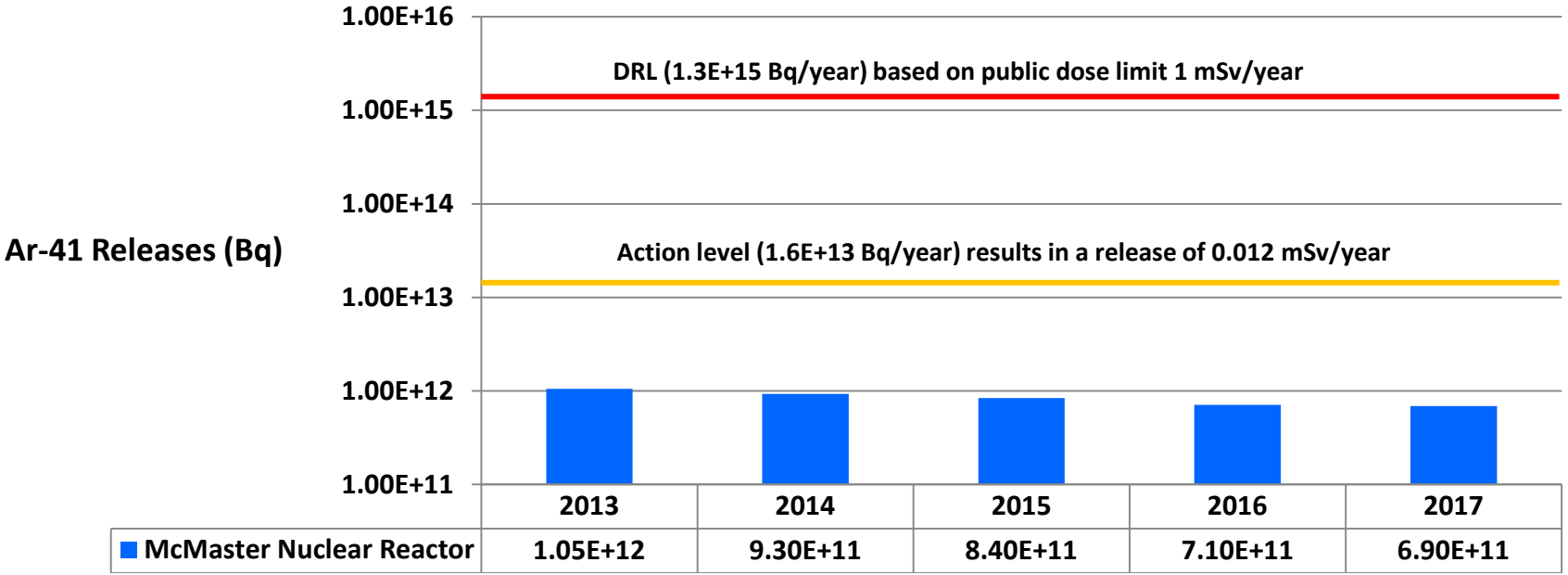
Environmental Protection SCA

This SCA encompasses the following relevant specific areas for Research Reactors: Effluent and Emissions Control (releases), and Assessment and Monitoring

- Airborne releases small – Undetectable at SLOWPOKES
- MNR has environmental monitoring stations
- No liquid releases at any of the Research Reactors

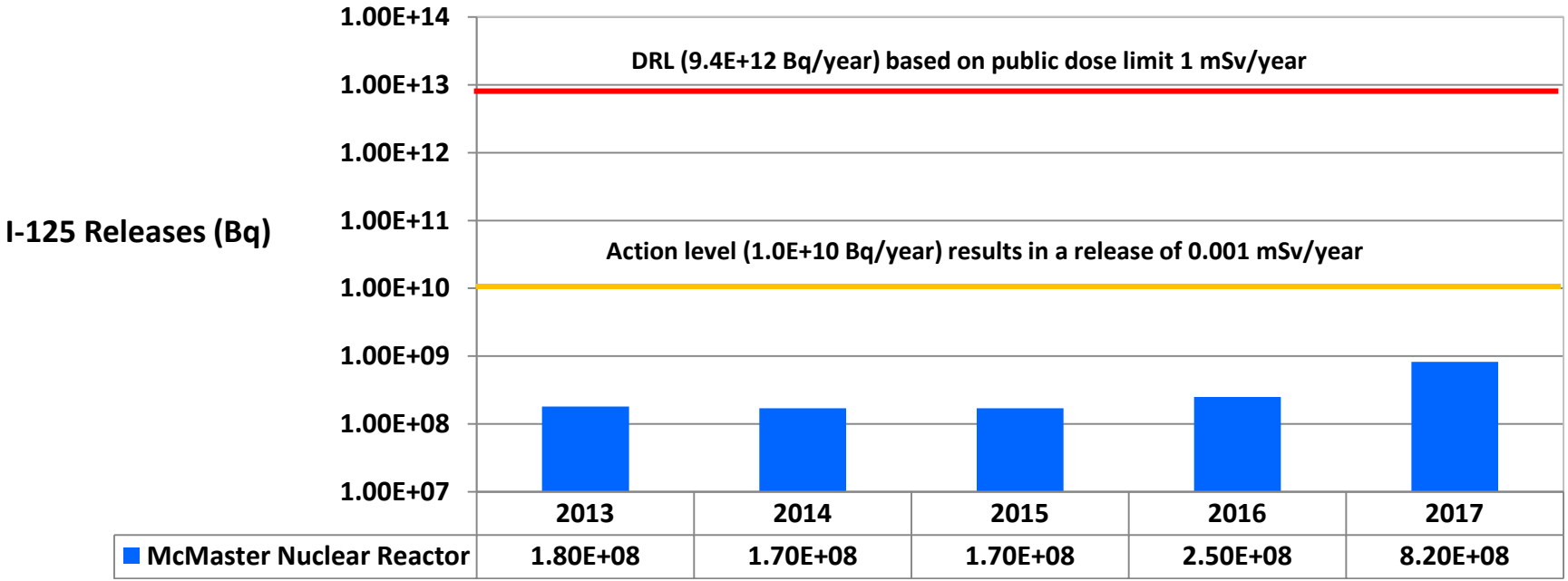
All research reactor facilities were rated Satisfactory for this SCA

Environmental Protection – MNR Argon-41 releases



	2013	2014	2015	2016	2017
McMaster Nuclear Reactor	1.05E+12	9.30E+11	8.40E+11	7.10E+11	6.90E+11

Environmental Protection – MNR Iodine-125 Releases



Conventional Health and Safety SCA

This SCA encompasses the following relevant specific areas for Research Reactors: Performance, Practices and Awareness

- There were no lost-time injuries at any of the small research reactors during 2016 – 2017

All research reactor facilities were rated Satisfactory for this SCA

Other Matters of Interest

- Public Information and Disclosure
- Financial Guarantees
- Regulatory Developments

Public Information and Disclosure

- Required to implement Public Information and Disclosure programs
- Provide the public with timely information about the health, safety and security, and unusual occurrences
- All licensees provided operations information on their websites.
- Other communications activities:
  - Open houses
  - Outreach events
  - Facility tours
  - Community events

Financial Guarantees

- Licensees provide a guarantee with sufficient financial resources available to fund decommissioning activities:
  - dismantling, decontamination and closure of the facility
  - any post-decommissioning monitoring or institutional control measures that may be required
  - subsequent long-term management or disposal of all wastes, including used fuel
- Financial Guarantees are accepted by the Commission

The CNSC requires licensees to maintain and revise preliminary decommissioning plans every five years

Financial Guarantees Research Reactors

Facility	Nuclear Reactor Restricted Reserve value Canadian dollars	Other instruments
McMaster University	$12,539,090	N/A
University of Alberta	N/A Decommissioning completed	N/A Decommissioning completed
Saskatchewan Research Council	$5,100,000	N/A
Royal Military College of Canada	NA	Commitment from National Defence
École Polytechnique de Montréal	$498,160	Letter of credit for $800,000

Notes:

1. N/A: Not Applicable
2. RMCC is exempt since it is a federal entity owned by National Defence
3. Financial guarantee for École Polytechnique is currently under review

Regulatory Document Developments

Regulatory document	Publication	Status
REGDOC-2.2.2: *Personnel Training, Version 2*	2016	Implemented
REGDOC-2.14.1: *Information Incorporated by Reference in Canada's Packaging and Transport of Nuclear Substances Regulation, 2015*	2016	Implemented
REGDOC-2.9.1: *Environmental Protection: Environmental Principles, Assessments and Protection Measure, version 1.1*	2017	Implemented
REGDOC-2.10.1: *Nuclear Emergency Preparedness and Response, version 2*	2017	Implemented
REGDOC-2.13.1: *Safeguards and Nuclear Material Accountancy*	2018	Implementation plans
REGDOC-3.1.2: *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills*	2018	Implementation plans
REGDOC-3.2.1: *Public Information and Disclosure*	2018	Implementation plans

No gap in regulatory requirements

Updates to Industry Standards Applicable to Research Reactors

- Licence Conditions Handbooks are updated to reflect these changes as part of the periodic revision cycle

Standard	Published	Status
N286-12 (R2017) *Management system requirements for nuclear facilities*	**2012**	**Implementation plans**
N292.1-16 *Wet storage of irradiated fuel and other radioactive materials*	**2016**	**Implemented at MNR. Not applicable to SLOWPOKES**

CNSC staff verify the implementation as part of ongoing compliance verification activities

Conclusion Part 1 Research Reactors

- Research reactors operate safely
- No radiological dose limit exceeded
- No unauthorized environmental releases
- No lost-time injuries
- Research reactor facilities are rated Satisfactory or Fully Satisfactory in all 14 SCAs
- CNSC staff continue to provide regulatory oversight of the research reactor facilities in a risk-informed approach through:
  - inspections
  - review of licensee documents
  - effective implementation of CNSC's regulatory framework

Part 2

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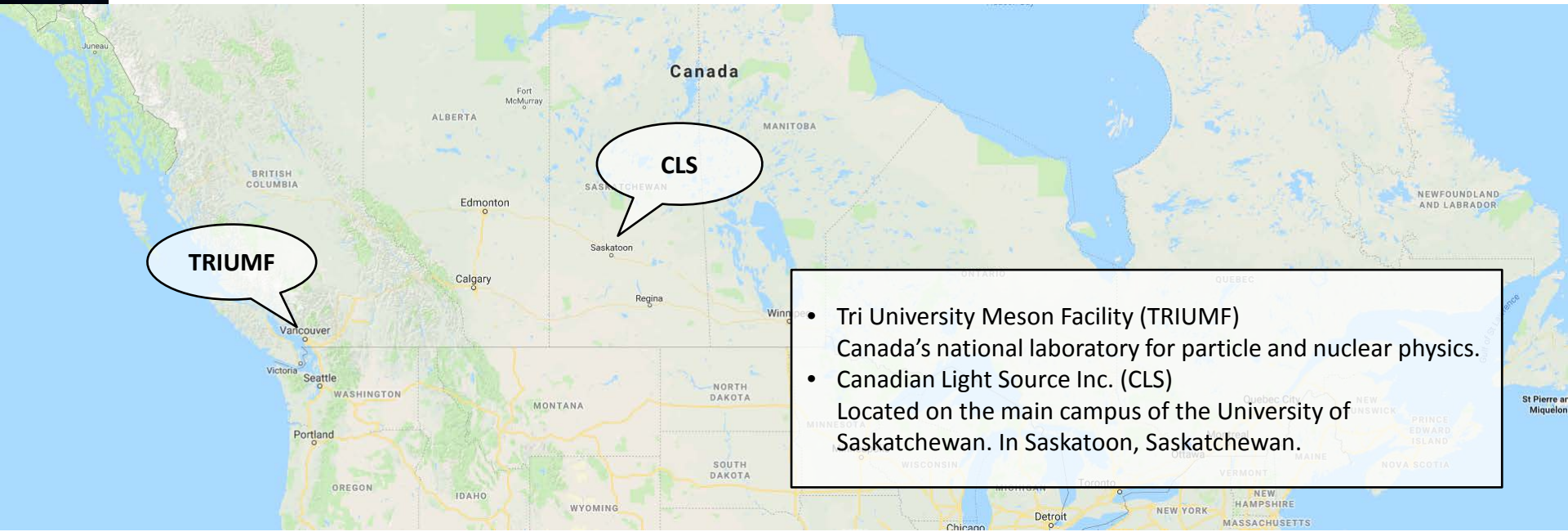
CLASS IB ACCELERATORS

Overview

Class IB accelerator facilities presented with research reactors:

- Similar low-risk
- Low environmental footprint
- Similar compliance programs

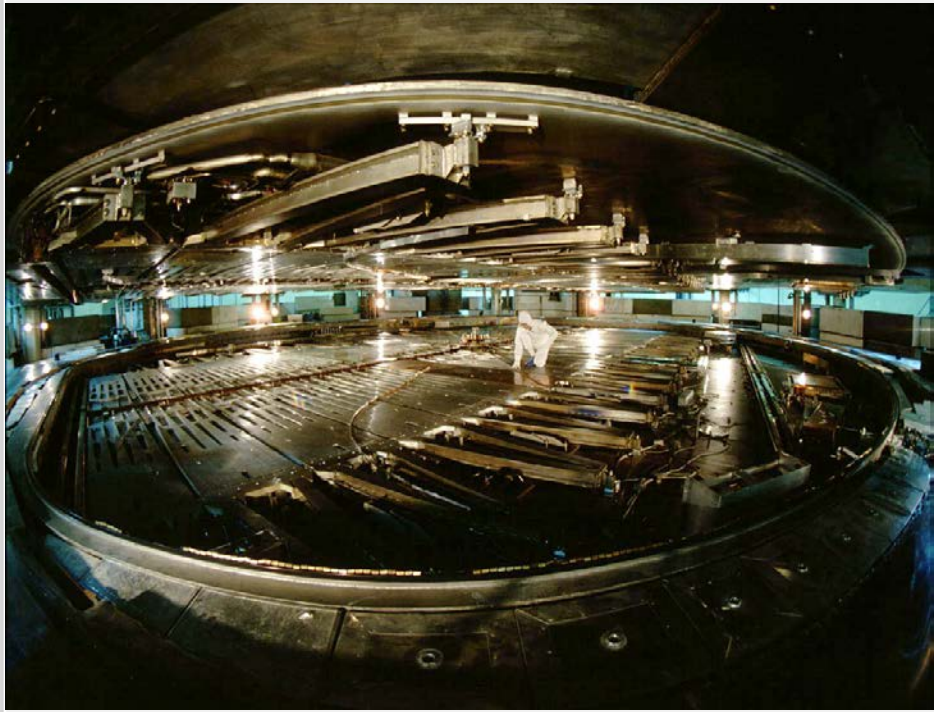
Class IB Particle Accelerator Facility Locations



- Tri University Meson Facility (TRIUMF)
  Canada's national laboratory for particle and nuclear physics.
- Canadian Light Source Inc. (CLS)
  Located on the main campus of the University of Saskatchewan. In Saskatoon, Saskatchewan.

TRIUMF

- TRIUMF is located on the University of British Columbia campus in Vancouver Commissioned in 1959
- Licence PA1OL-00/2022 issued in 2012 for a 10-year period
- The 520 MeV cyclotron accelerator has been in operation for over 40 years
- Medical isotopes
- Owned and operated as a joint venture by a consortium of 18 Canadian universities
- Approximately 560 persons working at TRIUMF



The photo on the right shows the 520 MeV cyclotron tank open.

Canadian Light Source Inc.

- CLSI operates a synchrotron facility, on the University of Saskatchewan campus in Saskatoon, Saskatchewan
- Licence PA1OL-02.01/2022 issued in 2012 for a 10-year period
- In operation since 2005
- Consists of three major accelerator systems:
  - 300 MeV linear accelerator
  - booster ring that accelerates electrons up to 2.9 Giga-electron volts (GeV)
  - storage ring that keeps electrons circulating at this energy for several hours

Inside look of the storage ring at the CLSI facility.

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PERFORMANCE AND REGULATORY OVERSIGHT

Performance Ratings for Class IB Accelerators 2016 – 2017

FS: Fully Satisfactory
SA: Satisfactory
BE: Below expectations
UA: Unacceptable

Explanation of rating methodology in annex of this presentation

Safety and control area	CLSI		TRIUMF	
	2016	2017	2016	2017
Management system	BE	SA	SA	SA
Human performance management	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA
Safety analysis	FS	FS	SA	SA
Physical design	FS	FS	SA	SA
Fitness for service	FS	FS	SA	SA
Radiation protection	FS	FS	SA	SA
Conventional health and safety	SA	FS	SA	SA
Environmental protection	FS	FS	SA	SA
Emergency management and fire protection	SA	SA	SA	SA
Waste management	FS	FS	BE	SA
Security	FS	FS	SA	SA
Safeguards and non-proliferation	N/A*	N/A*	FS	FS
Packaging and transport	FS	FS	SA	SA

* N/A: There are no safeguards verification activities associated with CLSI

Reported Events - TRIUMF

- June 2017: Irradiation of TR30-2 cyclotron cadmium target with a current of 375 µA for 30 minutes
  - Exceeded TRIUMF's licence operating limit of 350 µA for this type of target
  - There were no consequences as a result of the event
- August and September 2017: Two unintentional releases of 40 GBq of carbon-11
  - The releases amounted to 0.1% of the full site annual releases
  - Maximum dose received by individual < 0.3 µSv as a result of release

No safety consequences as a result of these events.
CNSC staff verified that corrective actions developed to prevent recurrence of both events have been implemented

Reported Events – CLSI (1/2)

- On July 14, 2016, a threat was made by an anonymous caller identifying himself as a member of ISIS. The incident was determined to be a hoax
- On October 12, 2016, CLSI discovered that an electrical disconnect switch was not locked in the 'off' position prior to working on 600V power supply
  - CLSI took appropriate actions to correct the Lock out Tagout (LOTO) process
  - CNSC staff conducted a targeted inspection to confirm the corrective actions were implemented

No safety consequences as a result of these incidents

Reported Events – CLSI (2/2)

- February 2017: A wiring error in the Linac Access Control Interlock System (ACIS) hardwire system was discovered
  - CLSI reviewed all accelerator ACIS design and installation and took appropriate actions

No safety consequences as a result of these events.
CNSC staff verified that corrective actions developed to prevent recurrence have been implemented

Regulatory Compliance

- The Class IB accelerators are low-risk facilities
- Primary risk is prompt radiation
- Environmental releases are very small
- Regulatory compliance efforts typically focus on:
  - radiation protection
  - environmental protection
  - conventional health and safety

Regulatory Effort Class IB Accelerators in 2016 – 2017

Facility	2016			2017		
	Inspections	Licensing (person-days)	Compliance (person-days)	Inspections	Licensing (person-days)	Compliance (person-days)
TRIUMF	3	8	156	2	4	144
CLSI	1	6	54	2	21	96
Totals	**4**	**14**	**210**	**4**	**25**	**240**

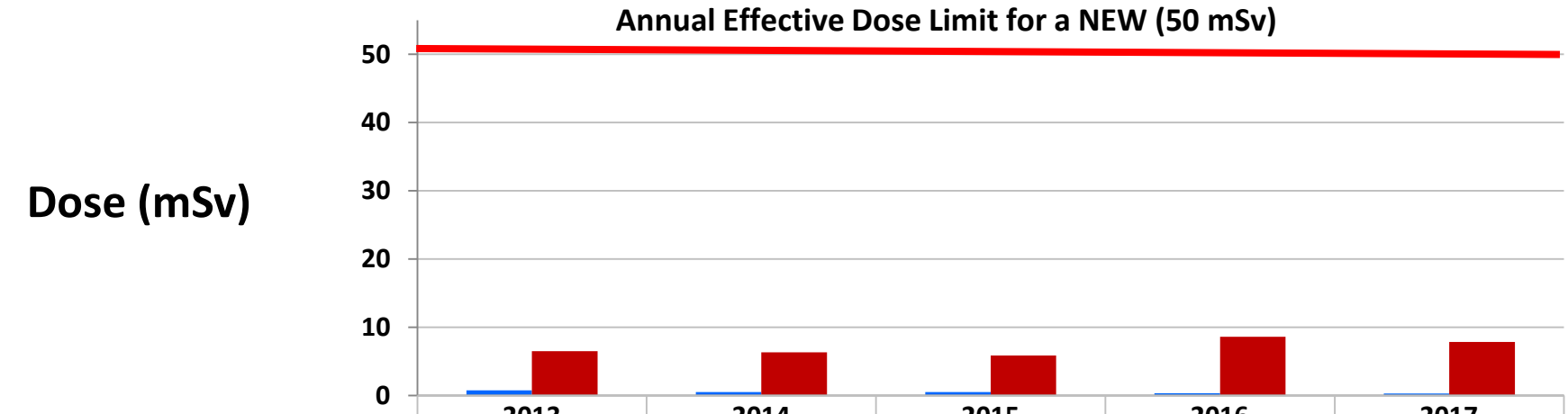
Radiation Protection SCA

This SCA encompasses the following specific areas:

- Application of ALARA
- Worker Dose Control
- Radiation Protection Program Performance
- Radiological Hazard Control
- Estimated Dose to the Public

The ratings for the Radiation Protection SCA for all Class IB accelerator facilities were Satisfactory or better and remain unchanged from previous five years

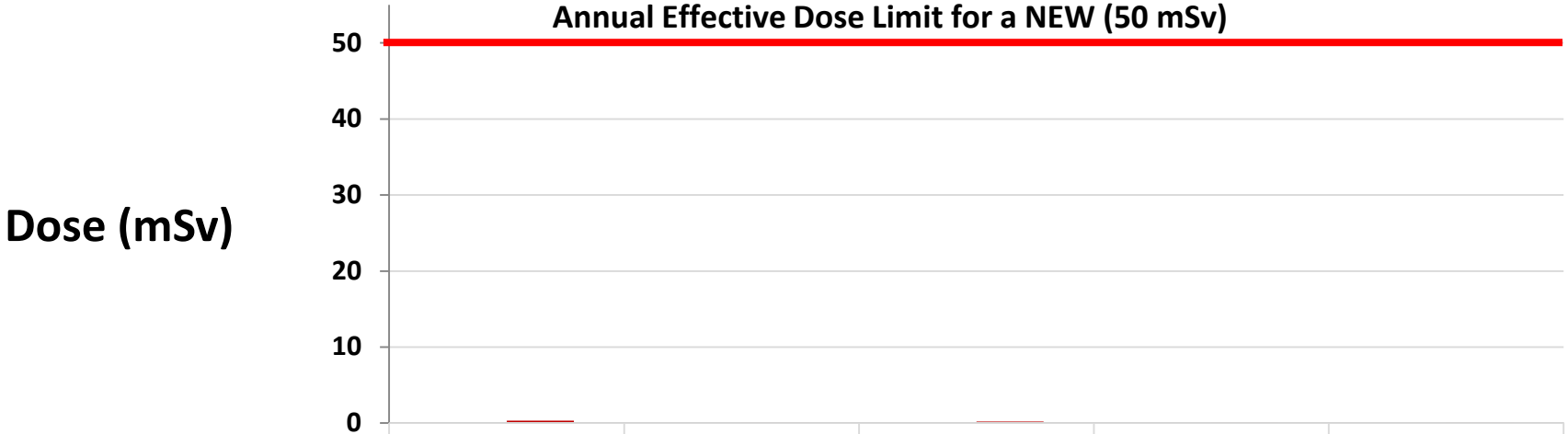
Radiation Protection (TRIUMF 5-year Trend)



	2013	2014	2015	2016	2017
Average effective dose (mSv)	0.77	0.52	0.49	0.33	0.29
Maximum effective dose (mSv)	6.49	6.32	5.87	8.62	7.85

Maximum dose to non-NEWS was 0.15 mSv

Radiation Protection (CLSI 5-year Trend)



	2013	2014	2015	2016	2017
Average effective dose (mSv)	0.06	0.01	0.01	0.01	0.004
Maximum effective dose (mSv)	0.31	0.14	0.19	0.12	0.08

Maximum dose to non-NEWS was 0.11 mSv

Radiation Protection

Maximum Effective Dose to the Public 2013 – 2017

- Maximum Effective Dose to a Member of the Public – TRIUMF

Dose Data	2013	2014	2015	2016	2017	Regulatory Limit
Maximum effective dose (mSv) TRIUMF	0.012	0.016	0.011	0.010	0.007	1 mSv/year

- Effective Dose to a Member of the Public – CLSI:

  Natural radiation background levels

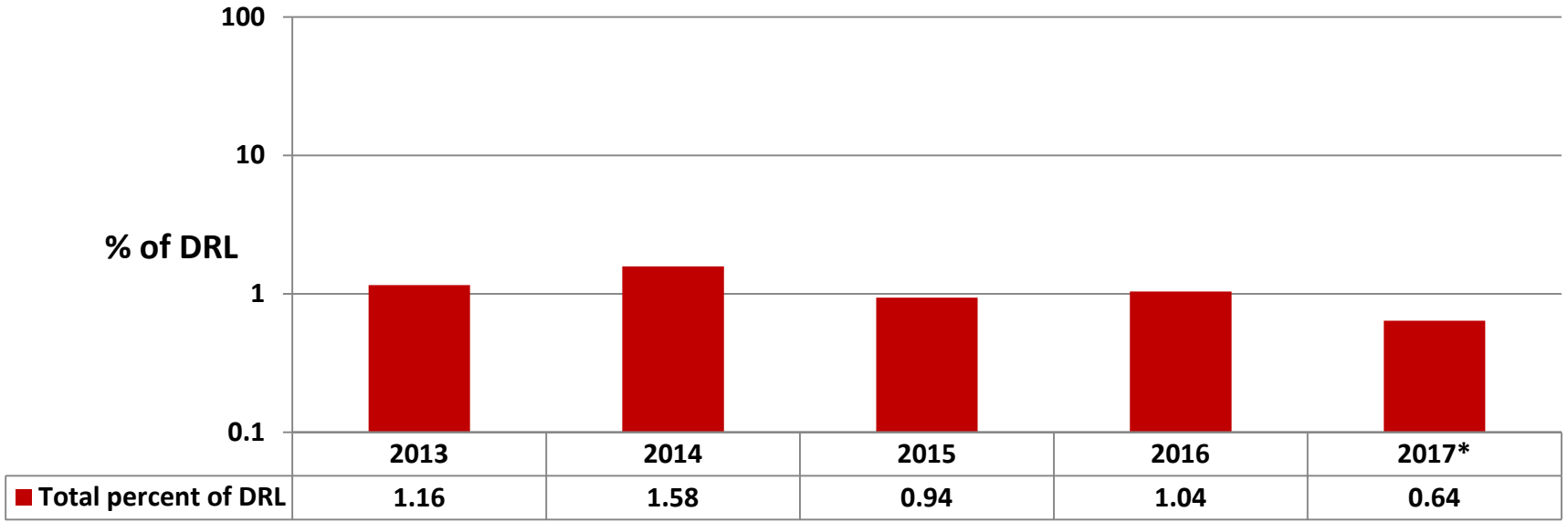
Environmental Protection SCA

This SCA encompasses the following specific areas for the Class IB Accelerators:

- Effluent and Emissions Control (releases)
- Environmental Management System (EMS)
- Assessment and Monitoring
- Protection of the Public
- Environmental Risk Assessment

Environmental protection SCA was rated Satisfactory for TRIUMF and Fully Satisfactory for CLSI

Environmental Protection (TRIUMF Airborne Releases)



	2013	2014	2015	2016	2017*
Total percent of DRL	1.16	1.58	0.94	1.04	0.64

* Updated Derived Release Limit (DRL) calculations to align with CSA N288.1-14

Environmental Protection
TRIUMF-Liquid Effluent Release to Sanitary Sewer 2013 – 2017

- Liquid effluent releases are being controlled effectively
- No action levels were exceeded

Parameter	2013 (% DRL) [a]	2014 (% DRL)	2015 (% DRL)	2016 (% DRL)	2017[b] (% DRL)
Total of various isotopes	3.79E-6	1.21E-6	3.81E-7	5.76E-7	4.61E-6

a: 100% of the Derived Release Limit equals a 1 mSv annual dose (regulatory limit for member of the public)
b: Updated DRL calculations to align with CSA N288.1-14

Environmental Protection (CLSI)

- CLSI operates an accelerator that does not produce any emissions
- An inspection was performed in July 2017 and confirmed that CLSI does not release radiological contaminants to the environment

Conventional Health and Safety SCA

- Satisfactory for all Class IB accelerator facilities
- Following the inspection in July 2017, the rating for CLSI increased from Satisfactory to Fully Satisfactory

Conventional Health and Safety
Class IB Accelerator Facilities Lost-time Injuries 2013 – 2017

- Lost-time injuries remained low: 4 LTIs for 2016 – 2017
- Class IB accelerators implemented Conventional Health and Safety programs satisfactorily
- Protected the health and safety of persons working in their facilities

Facility	2013	2014	2015	2016	2017
TRIUMF	3	0	4	0	3
CLSI	2	0	1	0	1

Other Matters of Interest

- Public Information and Disclosure
- Financial Guarantees
- Regulatory Developments

Public Information and Disclosure

- Required to implement Public Information and Disclosure programs
- Provide the public with timely information about the health, safety and security
- All licensees provided operations information on their websites
- Other communications activities:
  - Lectures
  - Outreach events
  - Facility tours
  - Community events
  - Social media

Financial Guarantees

- TRIUMF and CLSI provide a guarantee with sufficient financial resources available to fund decommissioning activities

Facility	Canadian dollar amount (Letter of credit)
CLSI	10,241,800
TRIUMF	10,800,000

Regulatory Document Developments

Class IB Accelerators

Regulatory document	Publication	TRIUMF Status	CLSI Status
REGDOC-2.2.2: *Personnel Training, Version 2*	2016	Implemented	Implemented
REGDOC-2.9.1: *Environmental Protection: Environmental Principles, Assessments and Protection Measures*	2017	Implemented	Implemented
REGDOC-2.13.1: *Safeguards and Nuclear Material Accountancy*	2018	Implementation plan	N/A
REGDOC-3.1.2: *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills*	2018	Implementation plan	Implementation plan
REGDOC-3.2.1: *Public Information and Disclosure*	2018	Implementation plan	Implementation plan

Updates to Industry Standards Applicable to Class IB Facilities

Standard	Publication	TRIUMF Status	CLSI Status
N286-12 *Management system requirements for nuclear facilities*	2012	Implementation plan Planned inspection Q4 2018	Implemented Planned completion in 2018

CNSC staff continue to verify the implementation of the most recent updates

Conclusion

- Class IB accelerators operate safely
- All Class IB accelerator facilities were rated Satisfactory or Fully Satisfactory all 14 SCAs in 2017
- No radiological dose limit exceedances to the public or the workers
- Releases to the environment are well below regulatory limits and do not pose a risk to people or the environment
- Licensees have implemented corrective actions where required
- CNSC staff continue to provide regulatory oversight of the Class IB accelerator facilities in a risk-informed approach through:
  - inspections
  - review of licensee documents
  - effective implementation of CNSC's regulatory framework

Overall Conclusion (1/2)

- CNSC staff spent 961 person-days on regulatory compliance activities, including 17 inspections over two years (2016-2017)
- CNSC staff's compliance activities confirmed that:
  - Radiation protection programs at all facilities were adequate in controlling radiation exposures and keeping doses as low as reasonably achievable
  - No radiological dose limits exceeded for the public or workers
  - Environmental protection programs were effective
  - Conventional health and safety programs at all facilities continue to protect workers
- Performance of research reactors and Class IB accelerators were satisfactory to fully satisfactory in all 14 SCAs in 2017

Overall Conclusion (2/2)

CNSC staff continue to:

- provide regulatory compliance oversight to all licensed facilities to ensure that the facilities continue to make adequate provision to protect the health, safety and security of workers, Canadians and the environment
- ensure the implementation of Canada's international obligations on the peaceful use of nuclear energy

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ANNEX 1

Commission Meeting, August 22-23, 2018
CMD 18-M32.A

RATING METHODOLOGY USED IN NUCLEAR CYCLE AND FACILITIES REGULATORY OVERSIGHT REPORTS

Outline

- Background
- Regulatory Oversight
- Rating Objectives
- Rating Methodology for Nuclear Cycle Facilities Performance Reports
- Conclusion

Background (1/2)

- Regulatory Oversight Reports include performance ratings
- CNSC staff rate licensee performance within each Safety and Control Area
- Internationally Canada is unique in:
  - Rating performance for fuel cycle program licensees
  - Presenting these reports in a public meeting
  - Offering public interventions and participant funding on the reports

Background (2/2)

- Detailed reporting on areas of interest to the public and Commission:
  - Radiation Protection
  - Environmental Protection
  - Conventional Health and Safety

  Key performance indicators directly linked to the CNSC mandate to protect health, safety and the environment

  - Other Areas of Concern or Major Improvements
- Performance ratings reflect our understanding and history with the licensed facility

Regulatory Oversight (1/2)

- Licensee performance is continually assessed by CNSC staff
  - Performance ratings do not replace day to day compliance and enforcement
  - Non-compliances are addressed with enforcement actions at the time they are discovered
- Compliance planning
  - Takes into account the risk associated with the type/complexity of the facilities or activities
  - Is flexible to allow for the broad range of licensee operations
- Compliance results come from various inputs such as inspections, technical assessments of licensee scheduled and unscheduled reporting and enforcement actions

Regulatory Oversight (2/2)

- Subject Matter Experts are organized into Facility Assessment and Compliance (FAC)Teams
  - Licensing, inspection and specialist groups collaborate using a multi-key approach in regulatory oversight in teams organized by licensed facility
  - These teams participate in compliance planning and oversight activities throughout the licence period and reflect a collective knowledge of each facility
- Compliance activities include:
  - Inspections at the licensed locations
  - Technical assessments of licensee submissions such as:
    - scheduled Annual Compliance Reports
    - unscheduled event or occurrence reports

Rating Objectives

- Provides overall picture to the Commission, public and Aboriginal Groups on performance in a transparent manner
- Trending of ratings over time can inform regulatory program
- Indicate to licensees where they need to focus effort and where they need to maintain current performance
- Highlight good performance

Rating Methodology Overview (1/2)

- Expert judgement/qualitative approach in evaluating and rating licensees' performance using performance indicators
- Based on evaluation of licensee's performance:
  - Since the last rating was assigned
  - Over the current licensing period including the significance of any enforcement actions issued and the licensee's response to those actions
- Ratings draw upon the FAC Teams' exposure to rating similar facilities within that Safety and Control Area and ensure knowledge is shared

Rigorous Methodology and Reproducible Ratings

Rating Methodology Overview (2/2)

- Each Safety and Control Area is evaluated individually and every facility has different inputs to the technical topic areas
- For example:
  - A rating may not have an input from onsite inspections in an SCA if none were conducted in that year
  - In these cases the rating input is based on the FAC team's assessment of scheduled and unscheduled reports since the last rating was assigned

Each Safety and Control Area is Evaluated Individually

Three Step Process Approach

1 Identify Compliance Results

- Inspections
- Technical Assessments
  - Scheduled and
  - Unscheduled Reports
- Enforcement actions
- Trends
- Performance indicators

2 Assess Compliance Results

- Regulatory requirements

3 Rate Performance

- Performance by SCA for each licensee

Identify Compliance Results

1. Identify Compliance Results
2.
3.

- Compliance results compiled by FAC Team
- The number and types of compliance results is facility specific and based on our risk-informed compliance plans
- Non-compliances are addressed as they are found and the Commission is updated on any significant findings at the time they occur

Assess Compliance Results

1 | **2 Assess Compliance Results** | 3

- Use a qualitative, expert based approach to assess compliance results against regulatory requirements using documented technical assessments
- Safety significance is assigned to non-compliances and enforcement actions
- CNSC Regulatory Information Bank database used to rank, monitor and report on non-compliances and enforcement actions and licensee commitments

Rate Performance (1/2)

1 → 2 → **3 Rate Performance**

- Scheduled and Unscheduled Reporting
- Inspection Results
- Non-compliances and enforcement Actions
  - Low, medium and high safety significance
- Performance Indicators and Trends
  - Lost-time injuries
  - Reportable events
  - Licensee response to events
  - Worker radiation doses
  - Environmental releases
  - Major improvements

FAC Team Considerations in Rating Performance

Rate Performance (2/2)

1 → 2 → **3 Rate Performance**

- Qualitative approach taken due to the number of compliance results considered for these licensees
- Consistency in rating between facilities and activities through FAC Teams' shared knowledge, lessons learned and mentoring
- Single reportable event or deficiency in a program area does not result in a licensee getting a BE or prevent a licensee from getting a FS
- Compliance results drive the rating in an SCA

UA	BE	SA	FS
Unacceptable	Below expectations	Satisfactory	Fully Satisfactory

Example 1: TRIUMF 2016 Waste Management SCA Rating

1 Identify Compliance Results

Inspections
- Type II Inspection with focus on Waste Management SCA

Technical Assessments
- Annual Compliance Report review

2 Assess Compliance Results

Inconsistent implementation of waste management program across site
- Incomplete inventory of radioactive and hazardous wastes for all storage areas on site
- Insufficient access control for some waste storage areas
- Some radioactive waste containers not labelled
- Lack of secondary containment for liquid wastes

3 Rate Performance

Enforcement Actions
- 1 Directive
- 4 Action Notices

Medium safety significance
- Inconsistencies and gaps for lower risk waste materials

- Generally well implemented program for high activity radioactive waste and/or very hazardous substances

UA | BE | SA | FS

Example 2: TRIUMF 2017 Waste Management SCA Rating

1 Identify Compliance Results

Inspections
- Type II Inspection with focus on Waste Management SCA

Technical Assessments
- Annual Compliance Report review

2 Assess Compliance Results

All previous Enforcement Actions fully addressed
- No new non-compliances observed
- Significant improvements over previous inspection findings

3 Rate Performance

Enforcement Actions
- ***NONE***

Recommendations
- 2 of 4 related to improving the inventory system

UA | BE | **SA** | FS

Example 3: McMaster 2016-2017 Security SCA Rating

1 Identify Compliance Results

- Type II inspections in Security SCA
- Technical Assessments
- Annual Compliance Report review

2 Assess Compliance Results

- Reactor converted from HEU to LEU in 2008 but security level was maintained (suitable for category II nuclear material)
- No non-compliances observed
- Good practices recognized
- Meet or exceed security requirements
- IPPAS mission recommendations addressed quickly and closed

3 Rate Performance

Enforcement Actions
- ***NONE***

Good practices recognized
- IPPAS mission
- relationship with local law enforcement

UA | BE | SA | **FS**

Conclusion

- Performance ratings utilize a qualitative, expert based approach that takes into consideration the wide variety of licences and relative risk ranking associated with the type of activity and associated hazards
- While the approach is qualitative, it is comprehensive, based on expert opinion and includes operational staff, subject matter experts and management to arrive at performance ratings

ANNEX 2

Commission Meeting, August 22-23, 2018
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INSPECTION REPORTS FOR 2016 – 2017

Inspection Reports – Research Reactors

Licensee	Report number	Inspection date
University of Alberta	NLRRD-UASF-16-T2-(08-03)	3/08/2016
Saskatchewan Research Council	SRC-2016-01	4/08/2016
Royal Military College	RMCC-SLWPK-2016-01	27/09/2016
McMaster Nuclear Reactor	MNR-2016-01	28/07/2016
University of Alberta	UoA-SLWPK-2017-01	3/10/2017
McMaster Nuclear Reactor	MNR-2017-01	23/11/2017
Saskatchewan Research Council	SRC-SLWPK-2017-01	23/11/2017
Ecole Polytechnique de Montreal	EPM-2017-01	7/12/2017
Royal Military College	RMCC-SLWPK-2017-01	13/12/2017

Inspection Reports – Class IB Facilities

Licensee	Report number/Area of inspection	Inspection date
TRIUMF	ACFD-TRIUMF-2016-02-11	9/02/2016
TRIUMF	ACFD-TRIUMF-2016-06-07	7/06/2016
TRIUMF	ACFD-TRIUMF-2016-10-27	25/10/2016
TRIUMF	ACFD-TRIUMF-2017-02-03	30/01/2017
TRIUMF	ACFD-TRIUMF-2017-10-26	24/10/2017
CLS	Inspection of: Management System	26/01/2016
CLS	Inspection of: Human Performance Management	24/01/2017
CLS	Inspection of: Environmental Protection, Conventional Health and Safety	25/07/2017