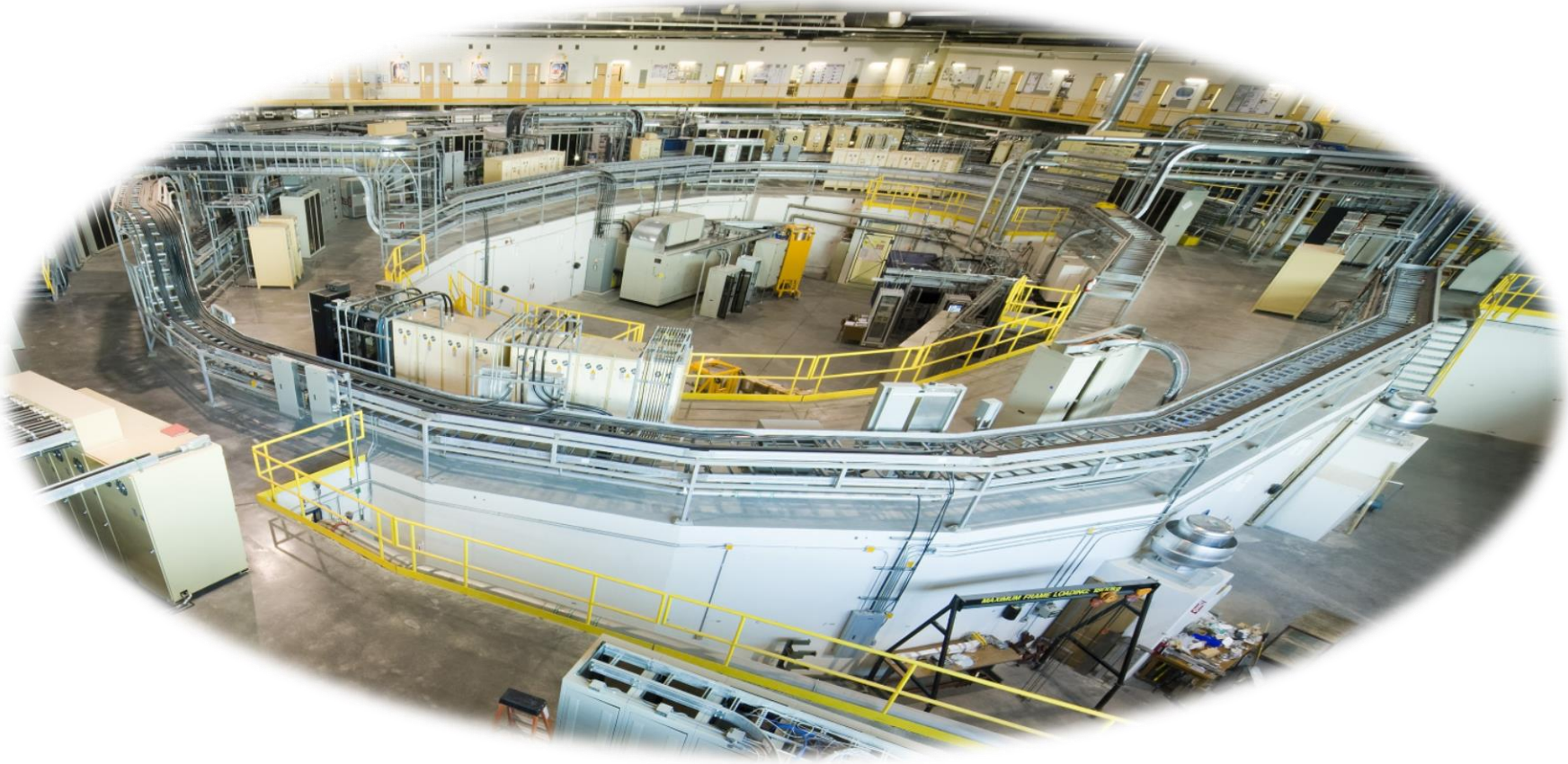
Canadian Light Source Non-Nuclear Energy Worker Dose Limit Exceeded



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CRPA Conference - June 2017, Saskatoon SK

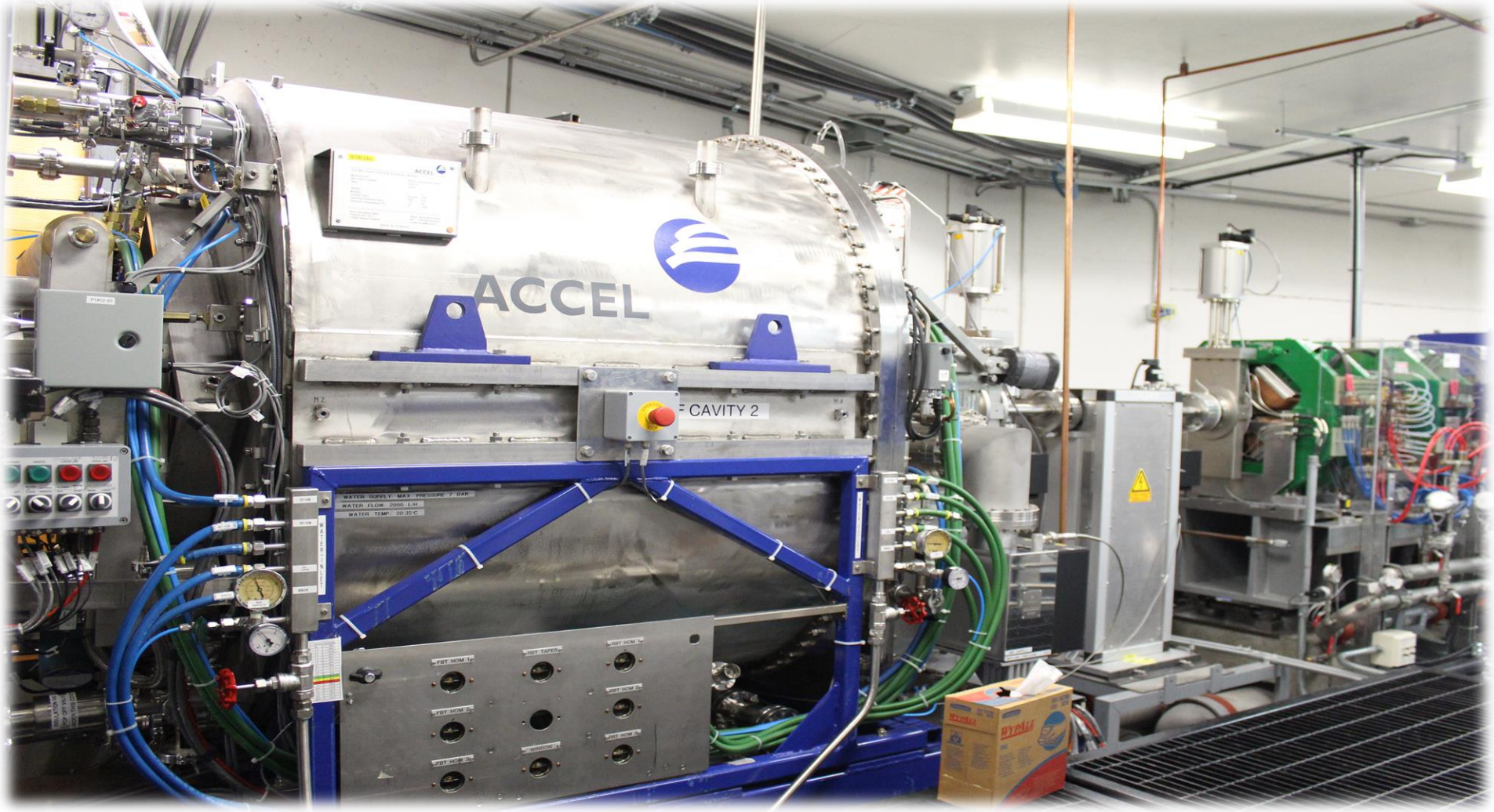
Outline

- CLS Introduction and Background
- Event (Personal Dose Limit Exceeded)
- Investigation
  - Interview
  - Review of Radiation Protection Program data
  - Surveys completed
- Immediate Actions Taken
- Conclusion
- Lessons Learned/Take-Aways

CLS Introduction

- Canada's only synchrotron light source
- Operate a high energy 2.9 GeV electron beam that produces synchrotron radiation
- Hold a CNSC Class 1B operating licence
  - Governed by CNSC acts/regulations
  - Radiation Protection Program
  - Health, Safety and Environment Department manage the program (Radiation Protection and Control Group)

Storage Ring Superconducting Cavity



CLS Background

- CLS is by-in-large a low dose facility
  - Engineering and administrative controls in place to reduce the risk
  - Defense in depth approach to safety systems
- Personal Dosimetry Monitoring
  - CLS monitor all personnel
  - Staff designated Nuclear Energy Workers (NEW) or Non-Nuclear Energy Workers (Non-NEW)
  - Quarterly exchange of personal dosimeters
- Area Restrictions
  - Experimental floor dose rates are <5.0 µSv/h
  - Shielding design criteria of <1.0 mSv for any single beam loss event

Personal Dose Limit Exceeded

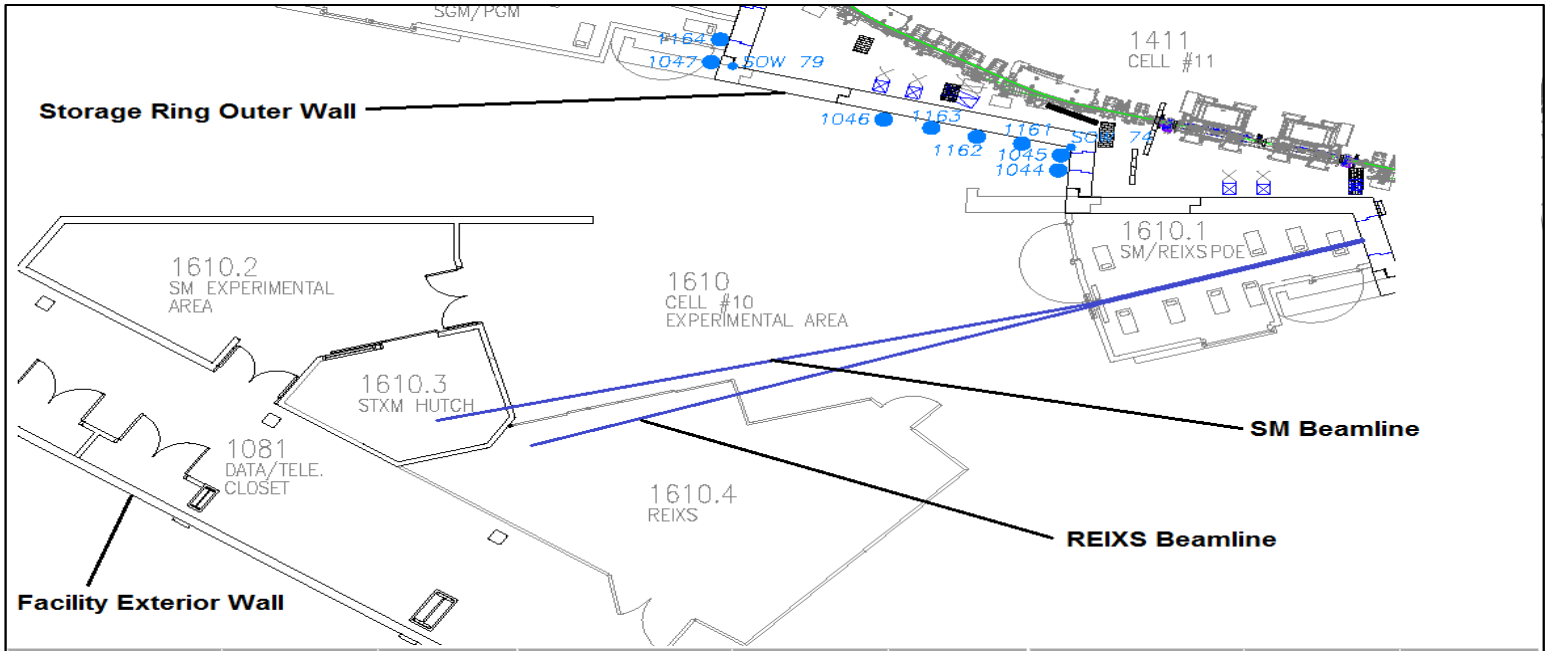
- CLS obtains Q3 personal dosimetry results from Landauer
  - Non-NEW scientific staff member with result of 2.72 mSv (Deep Dose Equivalent)
  - Reportable event to CNSC
- Regulatory Dose Limits Exceeded
  - Non-NEW dose limit of 1 mSv per year
  - CLS Non-NEW quarterly action limit is 0.2 mSv
  - Exceeding limits requires an investigation

Investigation

- Staff member contacted and interview was conducted
  - Confirmed that dosimeter had left CLS building during the dosimetry period
  - No work with radioactive material
  - Did not receive medical treatment
  - Not aware of any unusual events
- CLS asks Landauer to reread the dosimeter
  - No anomalies found, result is accurate
  - Results consistent with a dynamic exposure
- Investigation initiated

Review of Radiation Protection Program Data

- Passive Area Radiation Monitor results in SM Beamline area
- Other areas looked at on Storage Ring Outer wall (<0.46 mSv)



Participant Name	Map Number	Total DDE	Participant Name	Map Number	Total DDE	Participant Name	Map Number	Total DDE
1610 001	1044	0.05	1611 030	1045	0.11	1611 036	1162	0.46
1610 002	1044	0.05	1611 031	1045	0.14	1611 037	1162	0.40
1610 003	1044	0.03	1611 032	1161	0.31	1611 038	1163	0.40
1610 004	1044	0.06	1611 033	1161	0.23	1611 039	1163	0.24
1610 005	1045	0.04	1611 034	1161	0.25	1611 040	1163	0.24
1610 006	1046	M	1611 035	1162	0.67	1611 041	1046	0.13
						1611 042	1046	0.06

Review of Radiation Protection Program Data

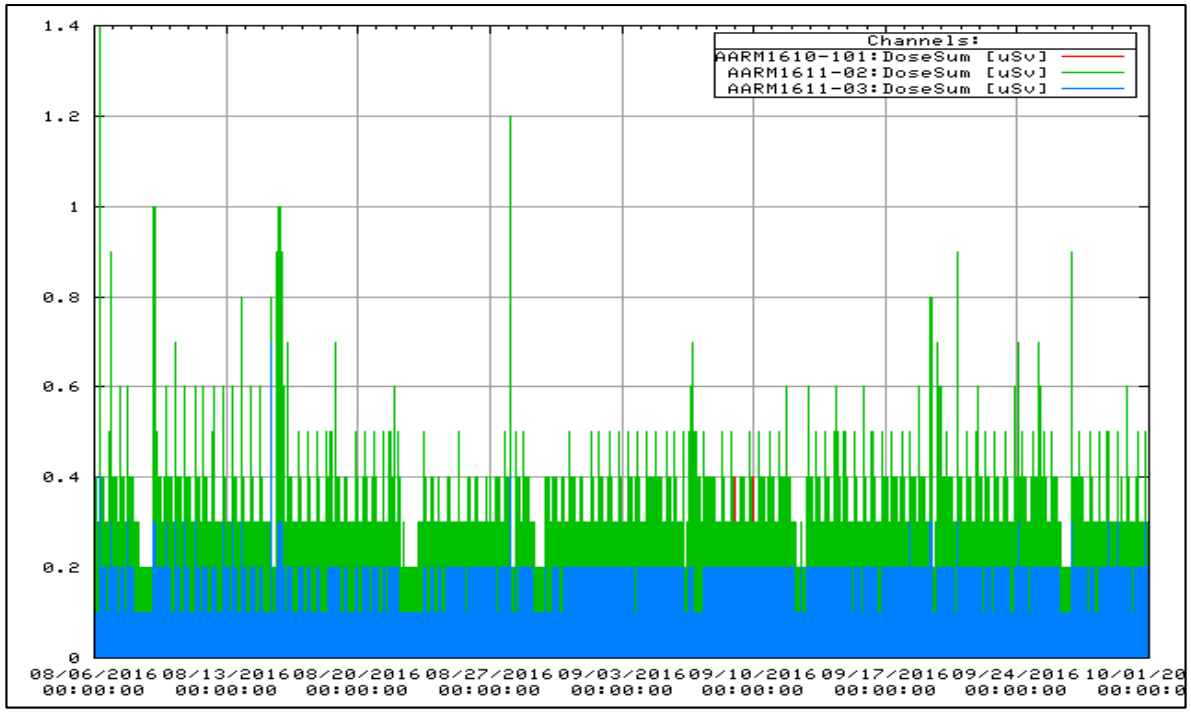
- Review of 6yr dosimetry history for staff member

Reporting Year	Quarter 1		Quarter 2		Quarter 3		Quarter 4	
	DDE	Neutron	DDE	Neutron	DDE	Neutron	DDE	Neutron
2016	M	M	M	M	2.72	M	M	M
2015	M	M	M	M	M	M	M	M
2014	M	M	M	M	M	M	M	M
2013	M	M	M	M	M	M	M	M
2012	M	M	M	M	M	M	M	M
2011	M	M	M	M	M	M	M	M

- Evidence that worker consistently worn dosimeter at CLS
- Personal dosimetry results for co-workers on same beamline
  - 5 co-workers reviewed, no positive dose
- Highest other result in Q3 was 0.05 mSv

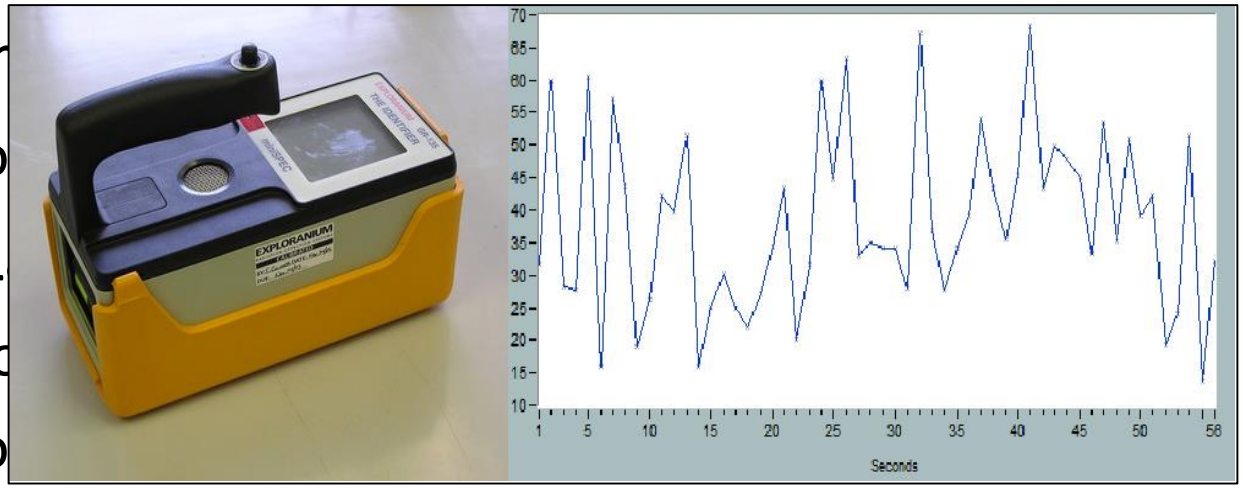
Review of Radiation Protection Program Data

- Active Area Radiation Monitoring System
  - 3 stations in area of SM beamline
  - No hourly dose exceeded 5 µSv (below design goal)



Review of Radiation Protection Program Data

- Routine operational survey
  - Storage Ring Outer wall during stored beam
  - Highest dose detected was 0.7 µSv/h
- Beam
  - No
- CLS L
  - Wo
  - No



- Two X-Ray generating devices near beamline
  - No leakage found

Immediate Actions Taken

- Actions taken to prevent further radiation exposure to individual
  - Assigned an Electronic Personal Dosimeter
  - Worker was restricted from working on the experimental floor
  - Personal dosimeter for Q4 was sent for rush analysis (result was no positive dose)

Conclusion

- Analysis of the data revealed no CLS system detected radiation that could have resulted in 2.72 mSv of dose
- Probability from a CLS source is extremely low
- External exposure is the probable cause
- CNSC has accepted report findings
- Dose possibly a combination of many external sources
  - medical x-rays
  - cosmic radiation from air travel
  - airline baggage scanning machines

Lessons Learned/Take-Aways

- Removal of personal dosimeters from CLS is an administrative problem
  - Not able to distinguish occupational dose
- Personal dosimetry is only accurate if worn/stored properly
- Radiation Protection Program was sufficient to analyze/determine with good certainty that dose was not received at CLS (defense in depth)
- The administrative action limits for personal dose are set to the appropriate levels

Questions?