



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire



The Regulatory Perspective on Radiation Protection in Canadian Uranium Mines

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Denis Schryer, Senior Project Officer
Canadian Nuclear Safety Commission

nuclearsafety.gc.ca

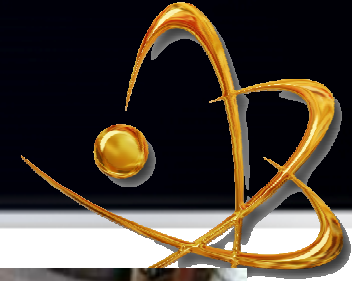
Outline



- CNSC and Nuclear Safety
- Radiation Protection Safety and Control Area expectations
- Regulatory Framework for radiation protection
- Radiation protection controls for ore mining in underground mines
- Conclusions



CNSC and Nuclear Safety



Licensing Stages- Uranium Mines



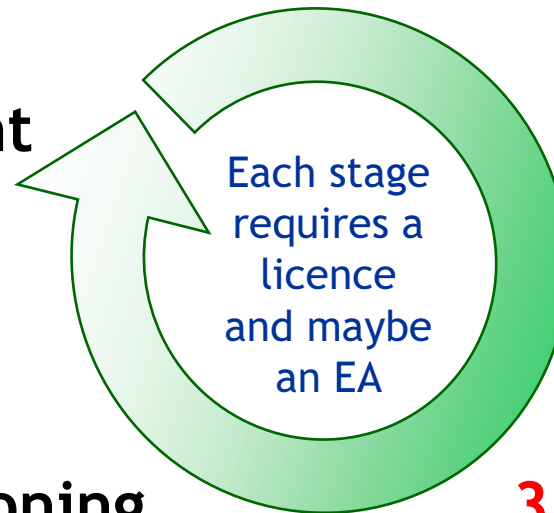
1. Site Preparation

2. Site Construction

3. Site Operation

5. Abandonment (Release from Licensing)

4. Decommissioning



Financial Guarantees also required for steps 1-4

Safety and Control Areas for Uranium Mine Facilities in Canada



- Mining and Milling Operations
- Waste Management
- **Radiation Protection**
- Environmental Protection
- Quality Assurance Program
- Worker Safety Programs
- Emergency Preparedness and Response
- Security
- Safeguards
- Public Outreach Program

Worker Radiation Protection Framework



Management Controls

- Risk assessments
- Work and Process controls
- ALARA program
- Training

Engineering Controls

- Mining method, Ventilation and Dust control
- Monitoring (internal and external)
 - Individual dosimeters
 - Continuous monitors with warning lights
 - Area/time monitoring
- Time-Distance-shielding

Administrative Controls

- Dose limits, Action Levels, Codes of Practice
- National Dose Registry (NDR)
- Periodic and Event Reporting

Effective Dose



$$ED_{\text{u/g miner}} = RP + RG + RD + G$$

RP = Radon Progeny (WLM)

RG = Radon Gas (Bq/Yr)

RD = Radioactive Dust (Bq/Yr)

G = Gamma (mSv)

Regulatory Dose Limits



Effective Dose Limits

- 50 mSv/Yr
- 100 mSv/5Yr

Radiation Exposure Components

- Radon Progeny: 4 WLM
- Radon Gas: 1.6×10^8 Bq
- Radioactive Dust: 2800 Bq
- Gamma: 20 mSv

Radiation Pathways & Controls

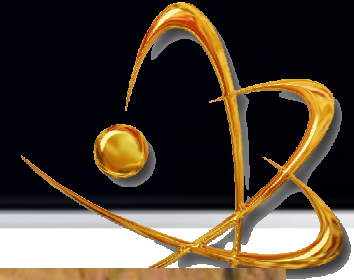


	Internal			External
	<i>Radon Progeny</i>	<i>Radon Gas</i>	<i>Radioactive Dust</i>	<i>Gamma</i>
Mine	Ventilation (Dilution, Source Control)	Ventilation (Dilution, Source Control)	Ventilation (Dilution, Source Control)	Time, Distance, Shielding
Mill	Ventilation	Ventilation	Ventilation	Time, Distance, Shielding
In Pit TMF	Not Required	Not Required	Not Required	Time, Distance, Shielding
Packing/ Transport	Not Required	Not Required	Ventilation	Time, Distance, Shielding

Mining in Ore



Shielding *- Shotcrete Application*



Distance Control - Remote Mucking



Radon Gas - Ventilation Source Control



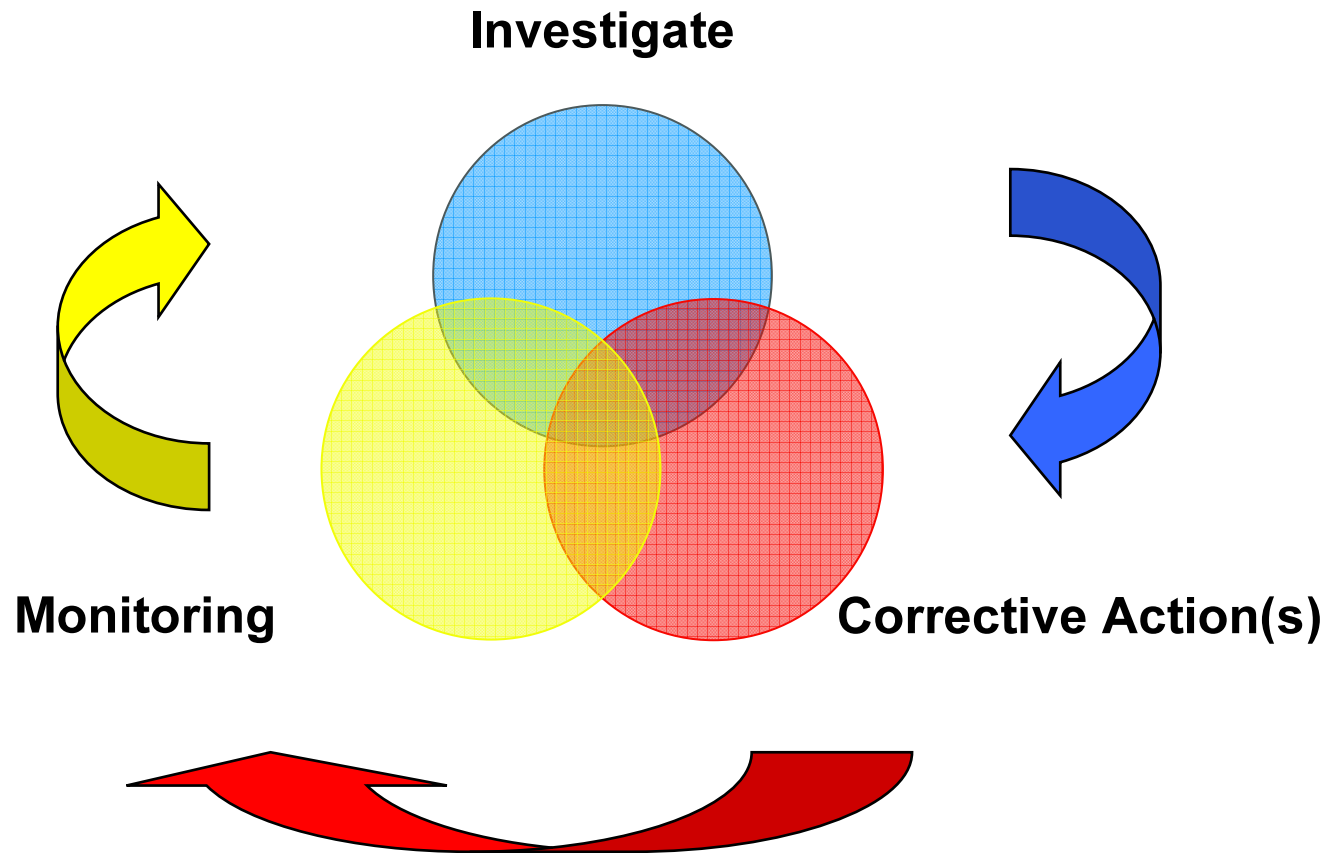
Radiation Monitoring - Grab Sampling



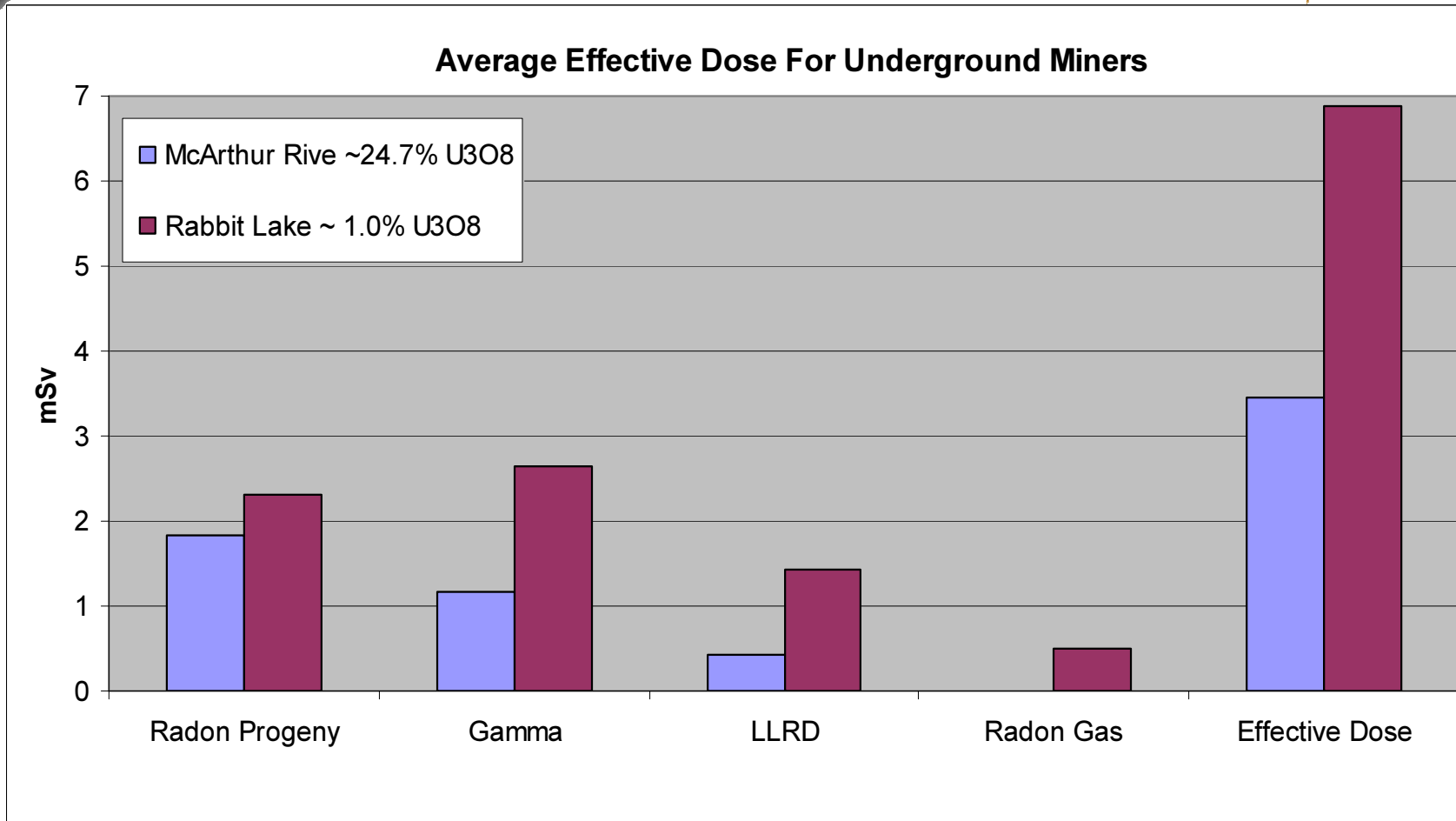
Radiation Monitoring - Continuous Sampling



Radiation Exposure Control Code of Practice Model



Effective Dose and Ore Grade



Conclusions



- CNSC is responsible for Nuclear Safety in Canada. We may be the lead regulator through our licence or provide advice to others on Radiation Protection concerns.
- CNSC expects its licensees to have high reliability performance, learn and continually improve through the ALARA process and self-report on deviations and events.
- An integrated and systematic regulatory framework of management, engineering and administrative controls provides effective Radiation Protection and is independent of ore grade or mining method.

Canadian Nuclear Safety Commission & Nuclear Regulation in Canada



More information at website:
<http://www.nuclearsafety.gc.ca>

Thank you,
Denis Schryer
Canadian Nuclear Safety Commission
Uranium Mines and Mills Division
Saskatoon, Saskatchewan





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