



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire

Environmental impacts measured around mining sites and regulatory framework



Canadian Nuclear Safety Commission

nuclearsafety.gc.ca

15 September 2014

e-Doc 4498510

Presentation Overview



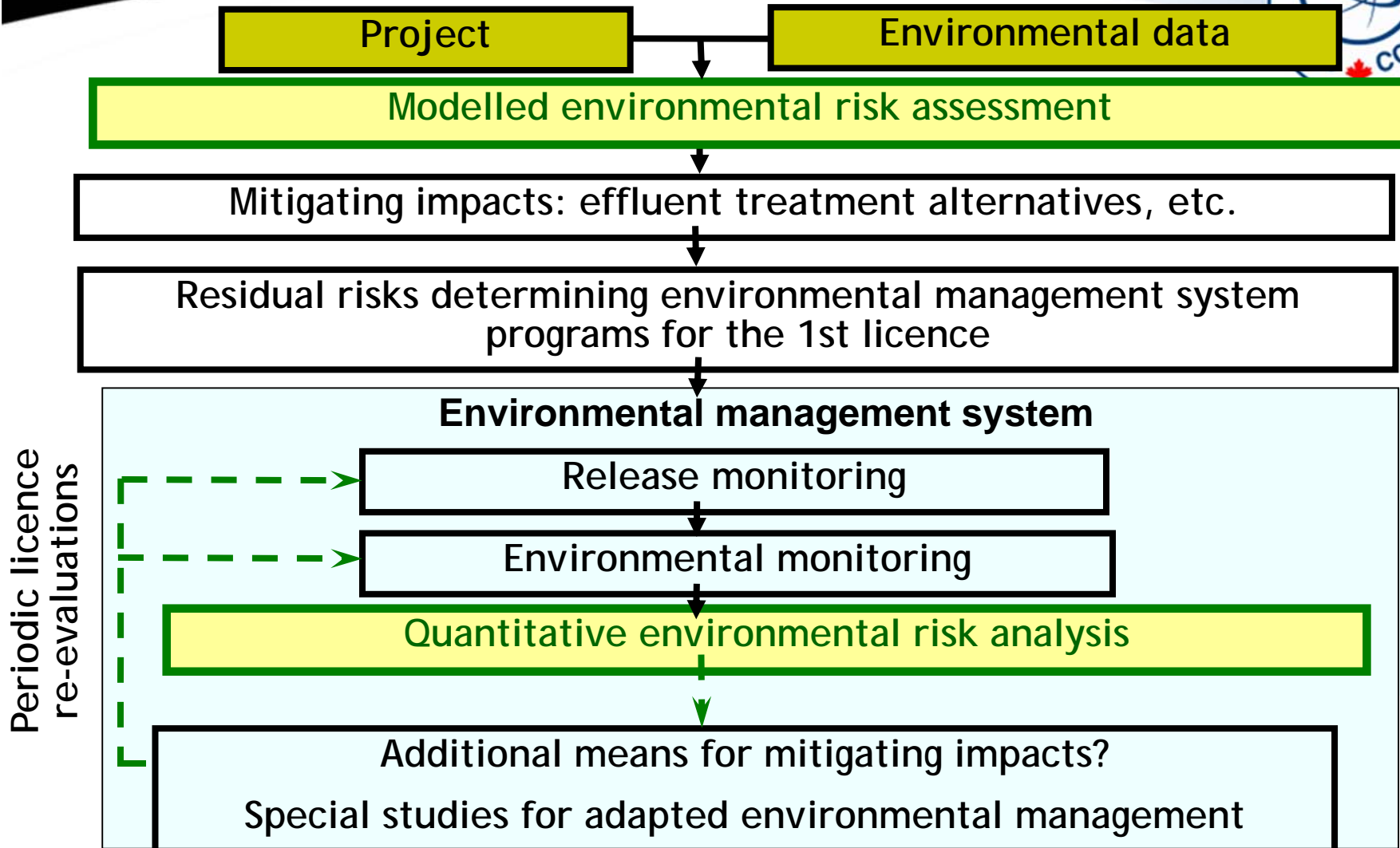
- Introduction
- Regulatory requirements:
 - Environmental assessments
 - Control and monitoring of liquid and gas effluent quality
 - Environmental monitoring
- Environmental protection program in effect:
 - Parameters measured and controlled in effluents
 - Environmental components subject to monitoring
 - Parameters measured in various compartments
- Impacts on the environment
- Conclusions

Federal and Provincial Regulatory Requirements

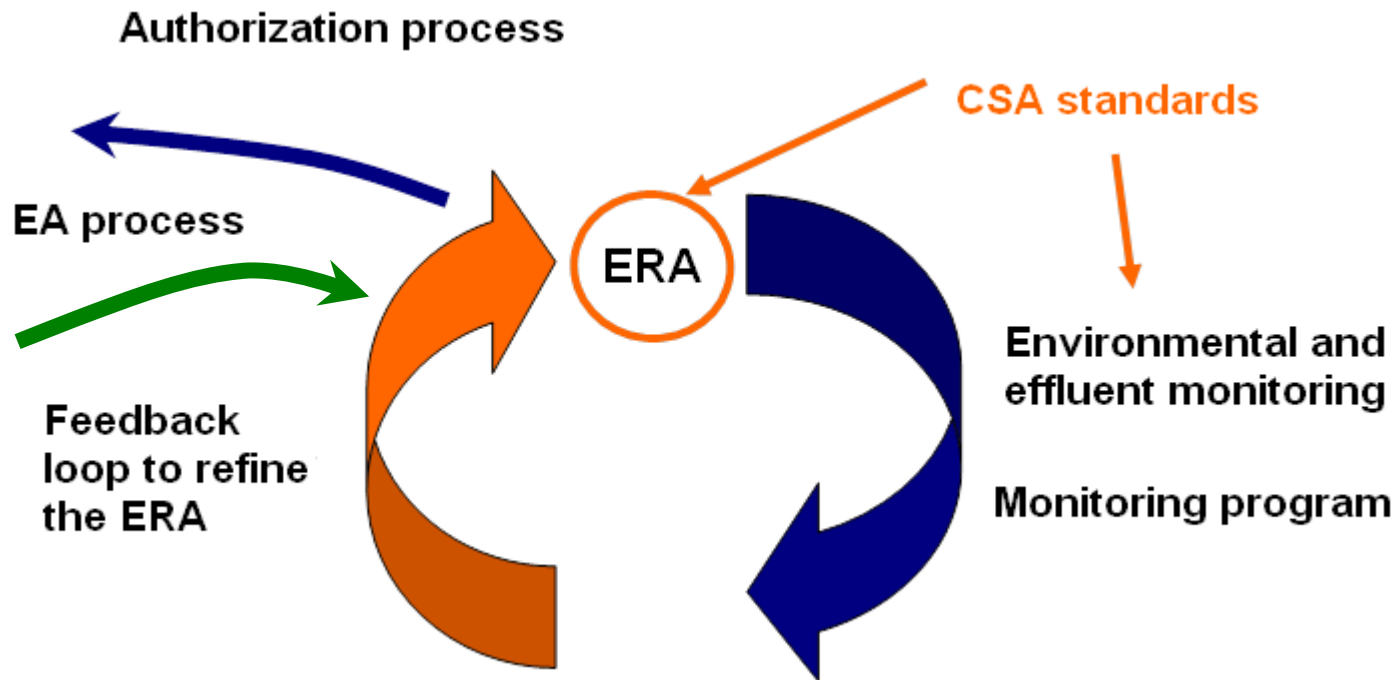


- Federal:
 - *Nuclear Safety and Control Act* and its regulations
 - Other federal acts and regulations related to environmental protection
- Provincial:
 - harmonization with provincial requirements

CNSC Regulatory Requirements



CNSC Regulatory Requirements (cont'd)



Parameters Measured and Controlled



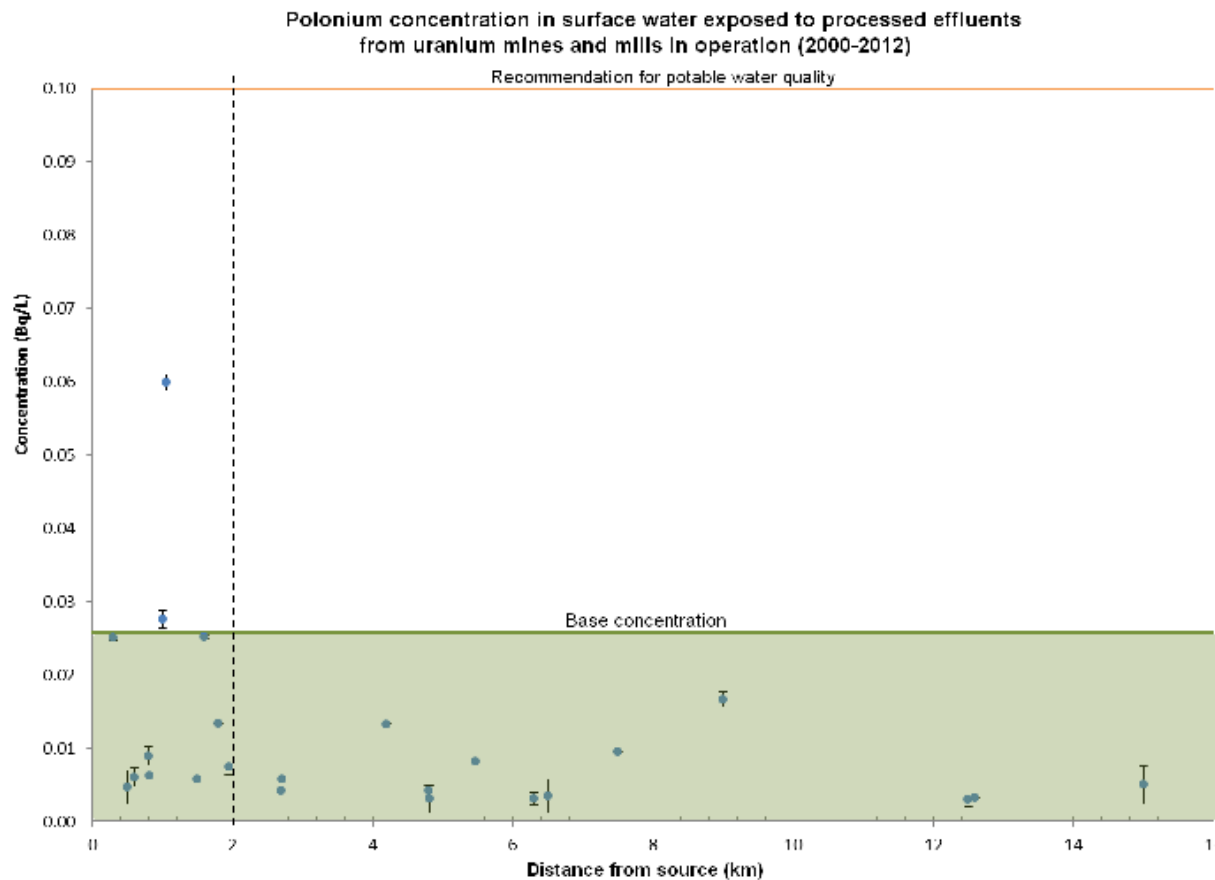
Pathway	Radioactive or hazardous substances measured	
Air	Radioactive	U-234, Th-230, Ra-226, Pb-210, Po-210, U-238, Rn and progeny
	Hazardous	As, Cd, Pb, Ni, U, Se, Cu, Mo Zn
Water (Effluents and downstream aquatic ecosystems)	Radioactive	Ra-226, Pb-210, Th-230, Po-210
	Hazardous	pH, NH ₃ , TSS, P, Al, As, Ba, B, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Se, V, Zn, U
Sediment	Radioactive	Ra-226, Pb-210, Th-230, Po-210
	Hazardous	Al, As, Ba, B, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Se, V, Zn, U
Fish	Radioactive	Ra-226, Pb-210, Th-230, Po-210
	Hazardous	Al, As, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Se, V, Zn, U
Soil	Radioactive	Ra-226, Pb-210, Th-230, Po-210
	Hazardous	pH, Al, As, Cd, Co, Cu, Fe, Mo, Ni, Pb, Se, V, Zn, U

Air and Soil Quality



- Air quality will be discussed in sessions on the effects of uranium mines on public health.
- Researchers at Laurentian University have demonstrated that doses to meadow voles, partridges and snowshoe hares are very low.
- Those same researchers have calculated minimal doses following the consumption of game, because radionuclides are found mainly in the bones rather than the muscles.

Water Quality Downstream from Uranium Mine Operations: Polonium-210



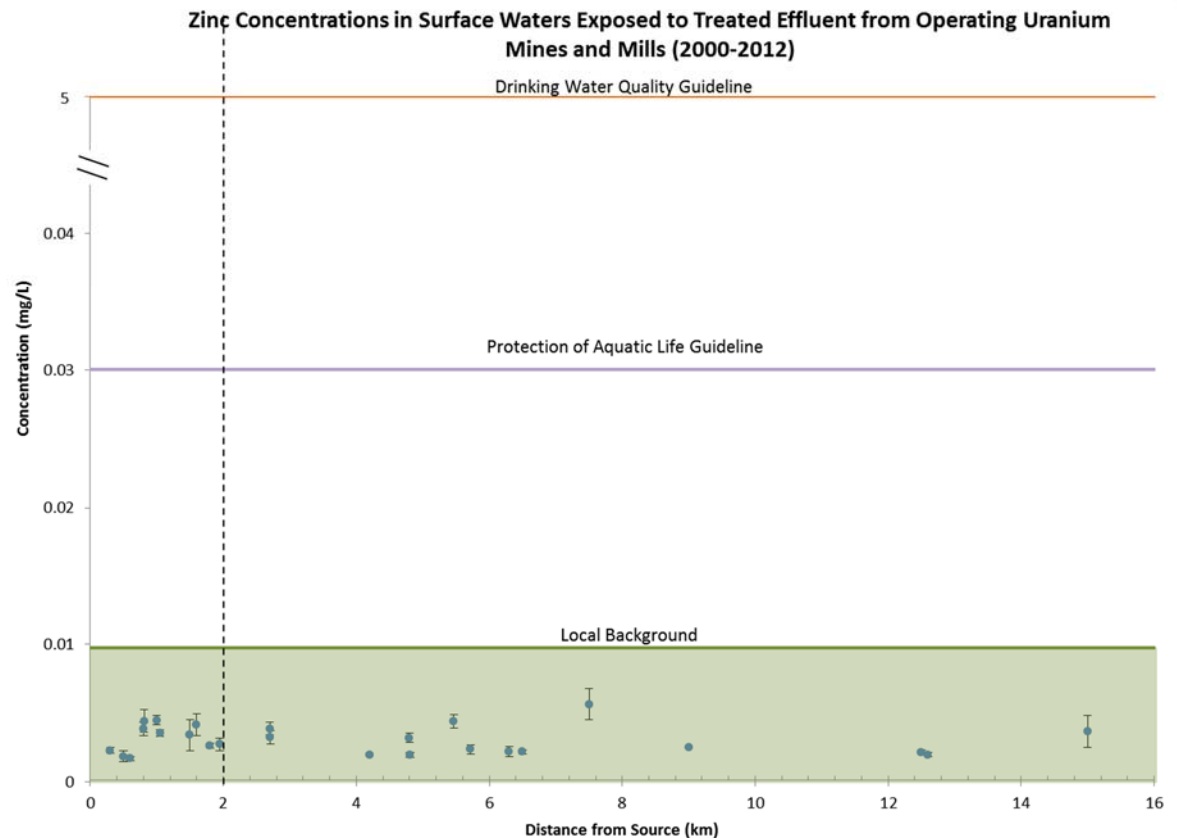
Note: No recommendation for the protection of aquatic life.

Radioactive substances are similar to natural concentrations 2 km downstream from the release point

Water Quality Downstream from Uranium Mine Operations: Zinc



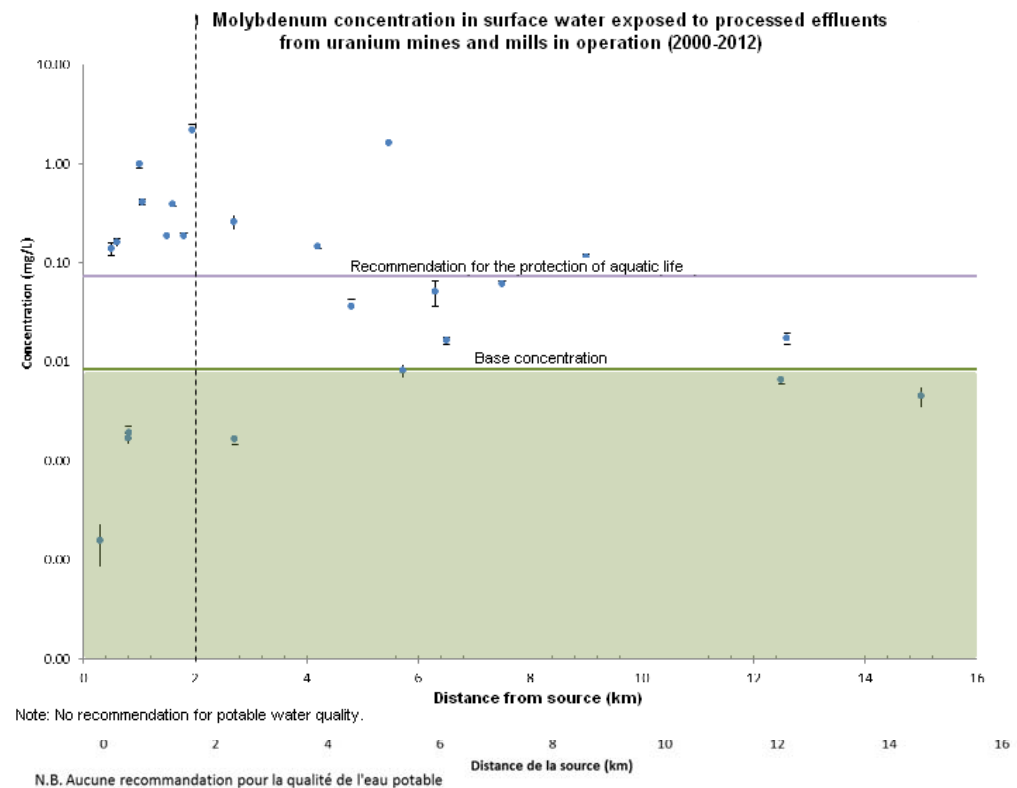
- Most hazardous substances meet the numerical targets for the protection of aquatic life at 2 km or more downstream from the release point
- As, Al, NH₃, B, Cd, Pb, Ni, V, Zn



Water Quality Downstream from Uranium Mine Operations: Molybdenum



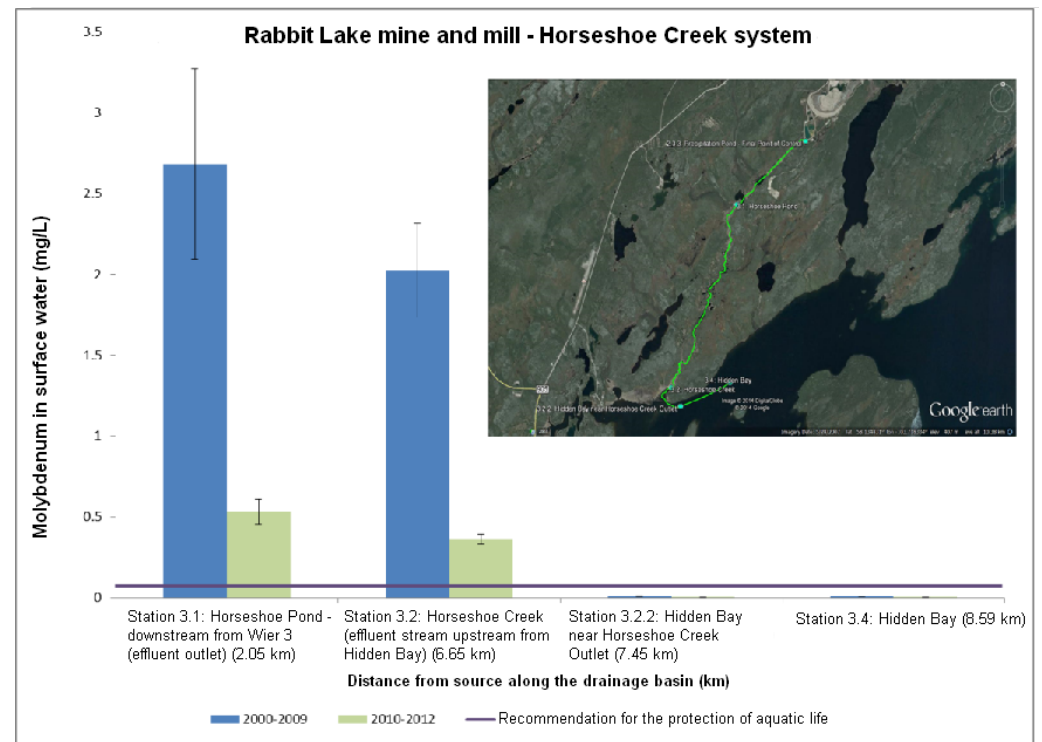
- U, Mo and Se sometimes exceed the numerical targets for the protection of aquatic ecosystems 2 km downstream from release points
- The CNSC required improved treatment to remove U, Mo and Se



Water Quality Downstream from Uranium Mine Operations: Molybdenum (cont'd)



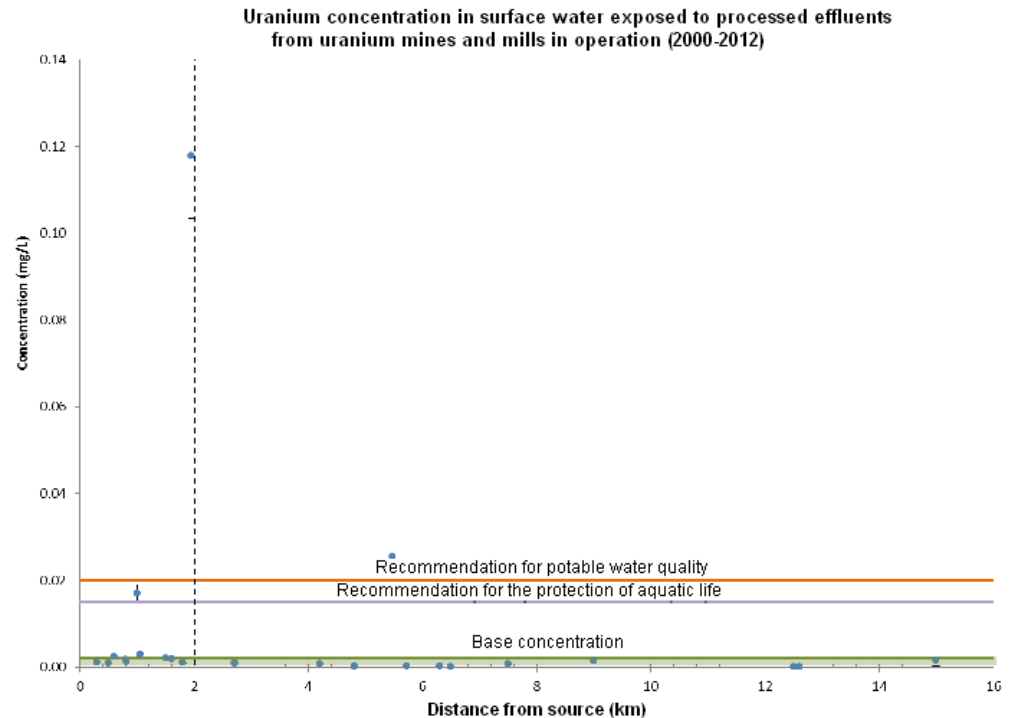
- There is no evidence that Mo affects the ungulate population
- Mo concentration has decreased since the implementation of CNSC requirements



Water Quality Downstream from Uranium Mine Operations: Uranium



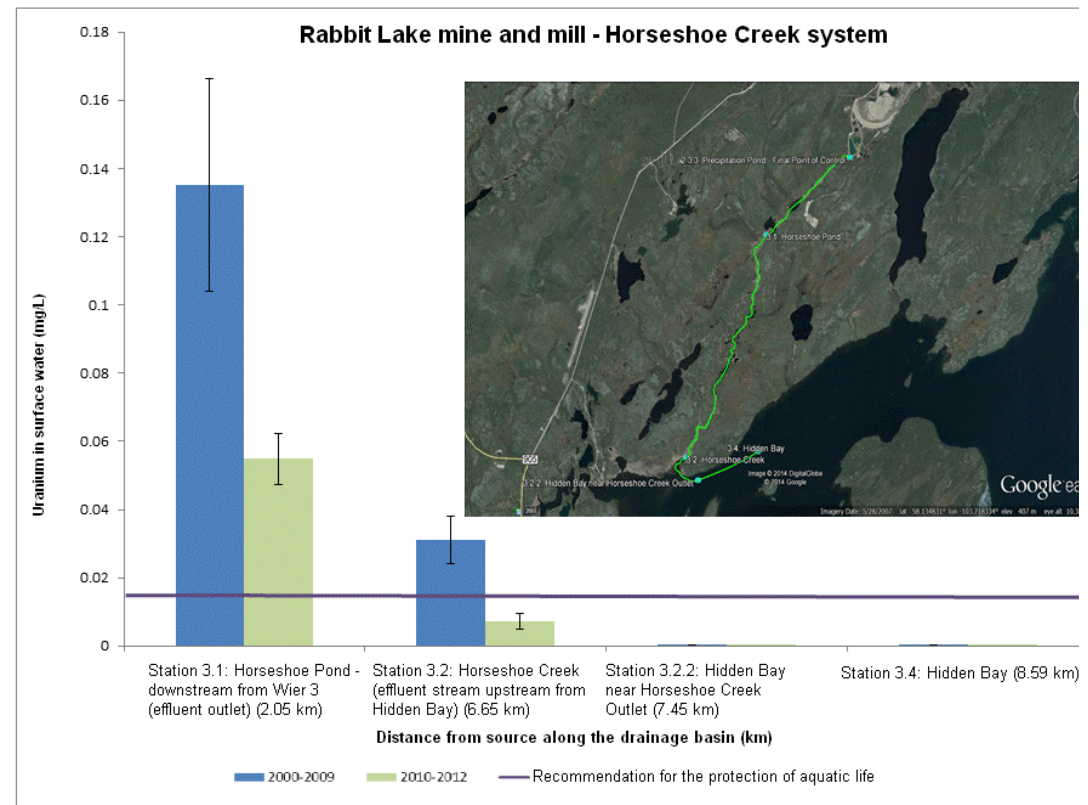
- Uranium is near natural concentrations, with recommendations for potable water quality and aquatic life protection downstream from the release point of most mines



Water quality downstream from uranium mine operations: uranium (cont'd)



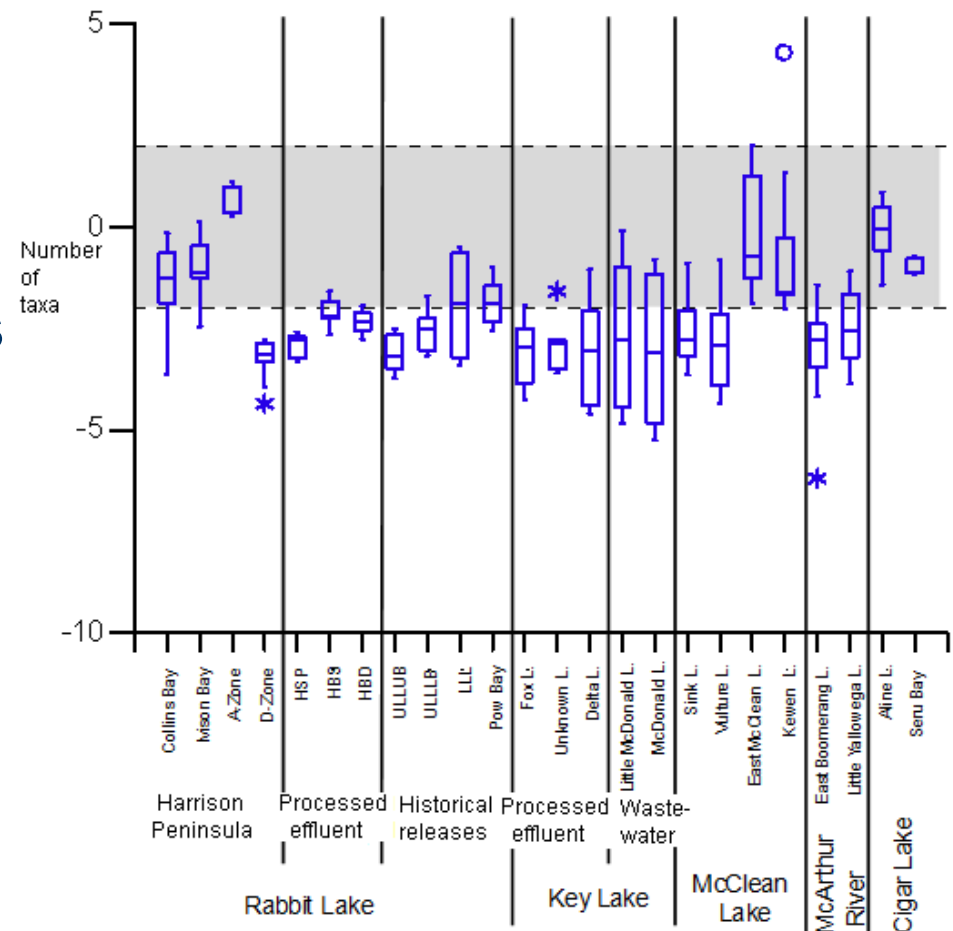
- The CNSC required improved effluent treatment
- The CNSC established a performance objective of 0.1 mg/L
- Uranium concentrations decreased.



Sediment quality: composition of benthic communities



- Accumulation of metals and radionuclides in sediments downstream from release points.
- The accumulation level varies with the quality of effluents and the length of operation.
- This accumulation can lead to a decreased number benthic invertebrate taxa.



Effects on fish communities: effect on weight



- Fish have a higher weight at a given age than unexposed fish.
- Gonad weight is also higher than that of unexposed fish.

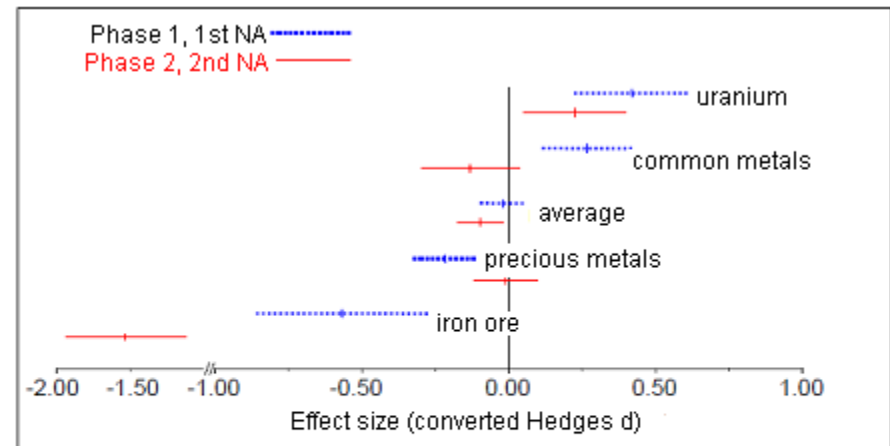


Figure 8. Fish weight according to age by mineral type in phase 1 (P1) studies conducted in the first national assessment period and in the phase 2 (P2) studies conducted in the second national assessment period. The error bars represent confidence intervals at 95%. Number of comparisons: uranium (P1=10, P2=11), common metals (P1=18, P2=15), precious metals (P1=33, P2=31), iron ore (P1=6, P2=5). (NA - national assessment)

Effects on fish communities: effect on age



- The fish are older than unexposed fish.
- Selenium causes congenital deformations and may reduce recruitment.
- Deformations caused by Se confirmed.

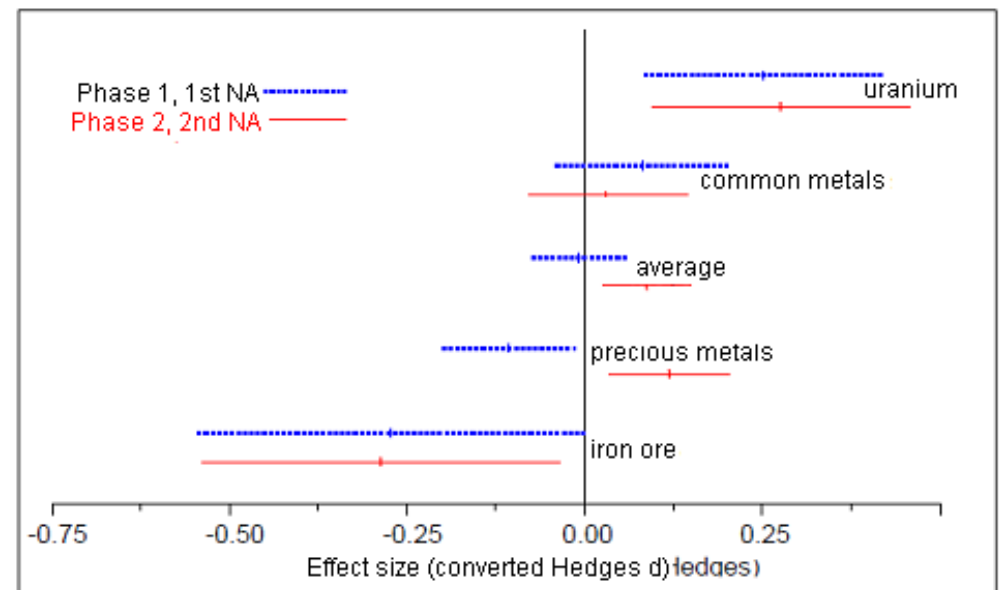
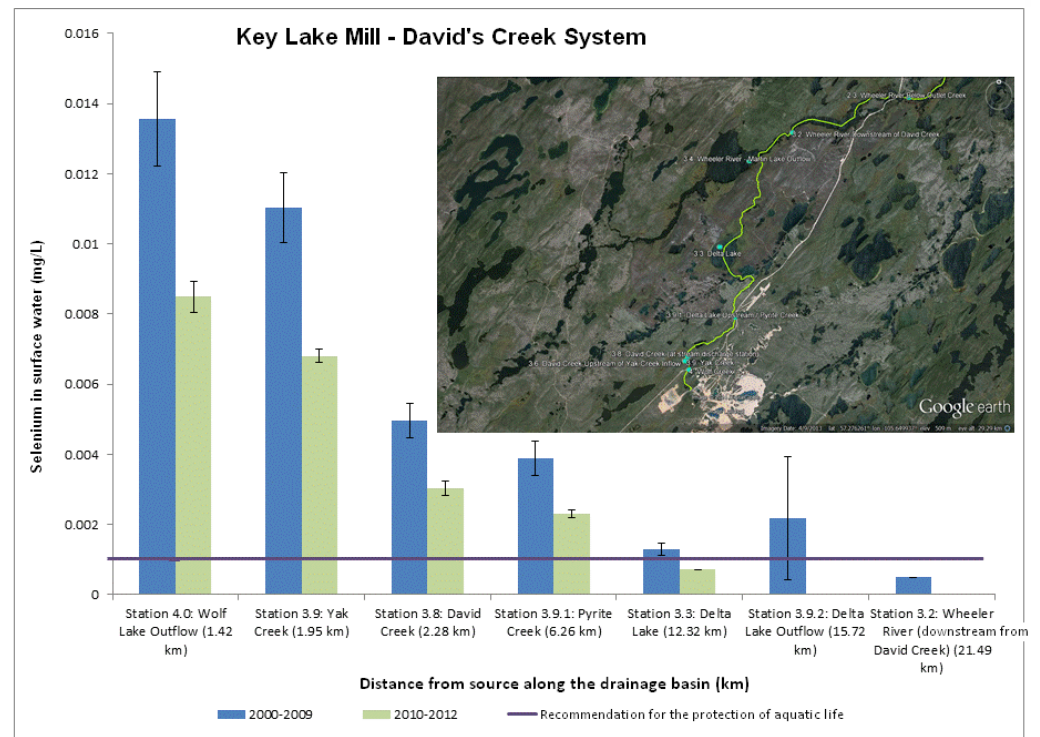


Figure 10. Fish age by mineral type in phase 1 (P1) studies conducted in the first national assessment period and in phase 2 (P2) studies conducted in the second national assessment period. The error bars represent confidence intervals at 95%. Number of comparisons: uranium (P1=13, P2=11), common metals (P1=23, P2=26), precious metals (P1=44, P2=47), iron ore (P1=6, P2=5). (NA - national assessment)

Water quality downstream from uranium mining operations



- The CNSC required improved effluent treatment.
- Se concentrations in effluents and in the receiving body of water were reduced.
- Treatment requirements will be in place for new facilities.



Conclusions



- In Canada, uranium mines are strictly regulated.
- The assessment, control and monitoring process helps better understand and minimize risks to the environment.
- Impacts on the receiving body of water are localized and at a level that does not compromise the integrity of biological communities and ecosystems.

For more information...



- Regulatory framework for the protection of the environment

[Hyperlink](#)

- Impacts of mines in operation on the environment

[Hyperlink](#)

- Background on the impacts of mines in the Elliot Lake area

[Hyperlink](#)



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Thanks!

