Risk management from mine planning to closure

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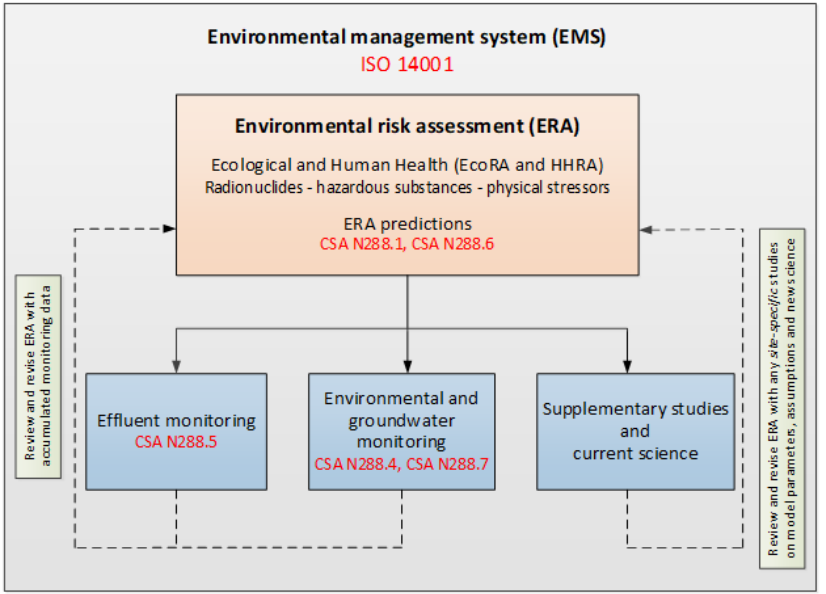
Plan

- Risk management at the centre of environmental protection
- What is needed at the project planning stage
- What should be done during operations
- What is needed at the project closure stage

Risk management throughout all stages of mining projects

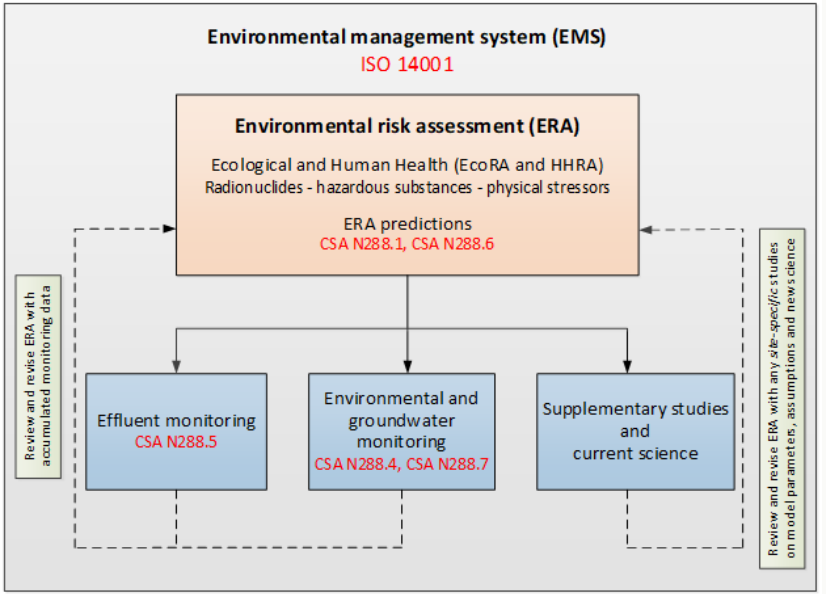
- Mining involves multiple phases, including planning, construction, operation, and decommissioning.
- **Environmental Risk Assessments** are conducted at all stages to predict potential impacts.
- **Risk managers** verify whether these predictions are met.
- If predictions are not met, **additional mitigation measures** may be required.
- **Note:** The regulatory process forms a **circular loop**, ensuring continuous monitoring and corrective actions throughout the mine's lifecycle.



From CNSC REGDOC 2.9.1.
REGDOC-2.9.1, Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.2 (cnsc-ccsn.gc.ca)

What is needed at the planning stage?

- Source term characterisation
  - Adequate characterisation of ML/ARD
  - Adequate characterisation of potentially airborne particles for dust exposure
- Source term input into environmental risk assessment models
- These risk assesment model predictions are based on the mitigation measures for mine waste and effluent management
- These predictions should be used to verify if mitigation measures work; When?

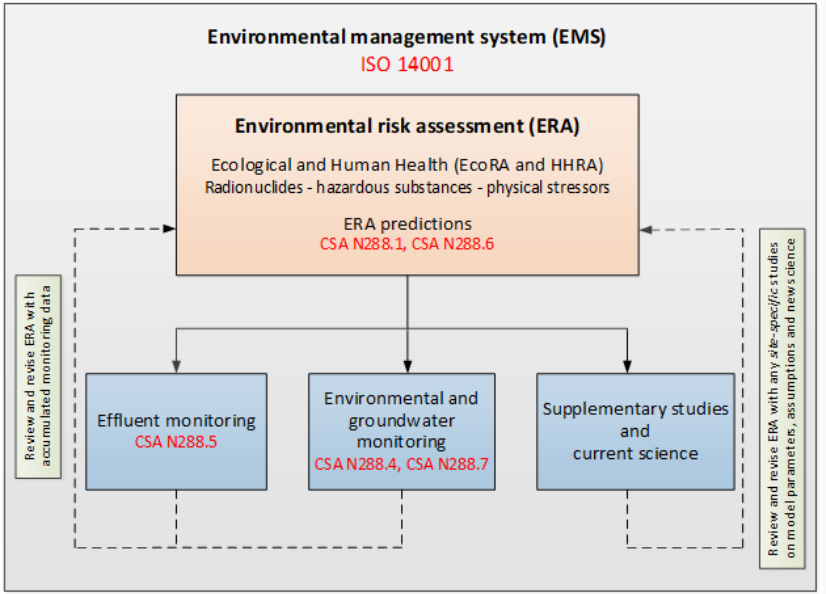


What are the gaps at the planning stage?

- New emerging risks associated with Critical minerals mining
  - Lithium
  - Rare Earth Elements
  - Platinum and Paladium

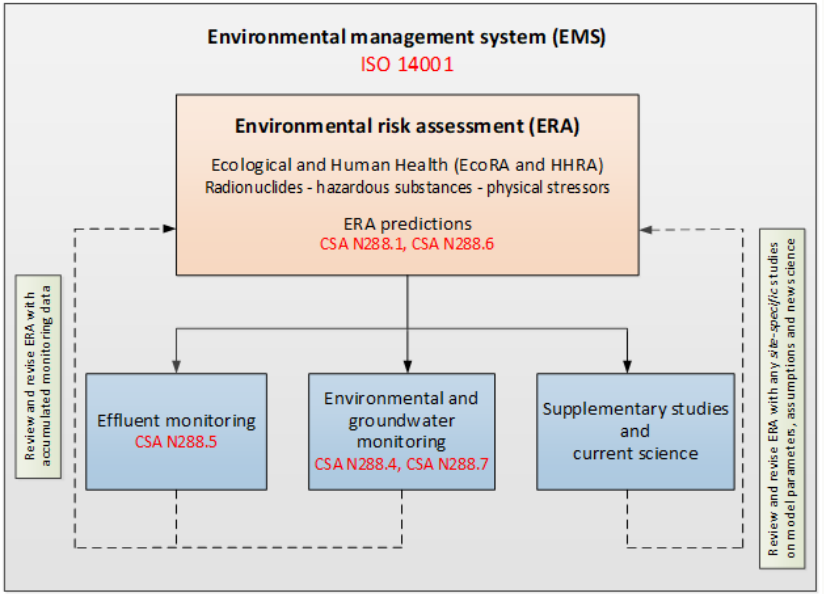
- Predictions made at the Impact Assessment Stage need to be considered during environmental monitoring

- Environmental monitoring should confirm the impacts are mitigated.



What are the gaps during operations?

- Source term characterisation:
  - Continue characterisation on blast cutting waste rock to confirm characterisation done on crush drill cores
- Environmental Monitoring:
  - Confirm impact assessment predictions
- Adaptive management:
  - improvement on effluent treatment, waste rock segregation, cover composition and thickness, etc…
- Risk Assessment:
  - Environmental monitoring and source term characterization data validate the predictive risk assessment model, turning it into a site-specific risk assessment tool
  - Inform on closure planning



What are the gaps at closure planning?

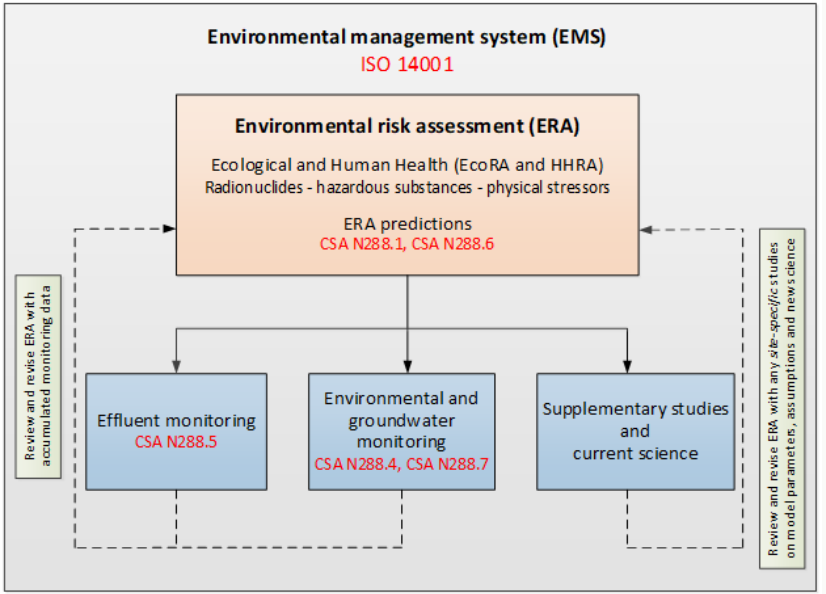
Are the mitigated impact assessment predictions confirmed?

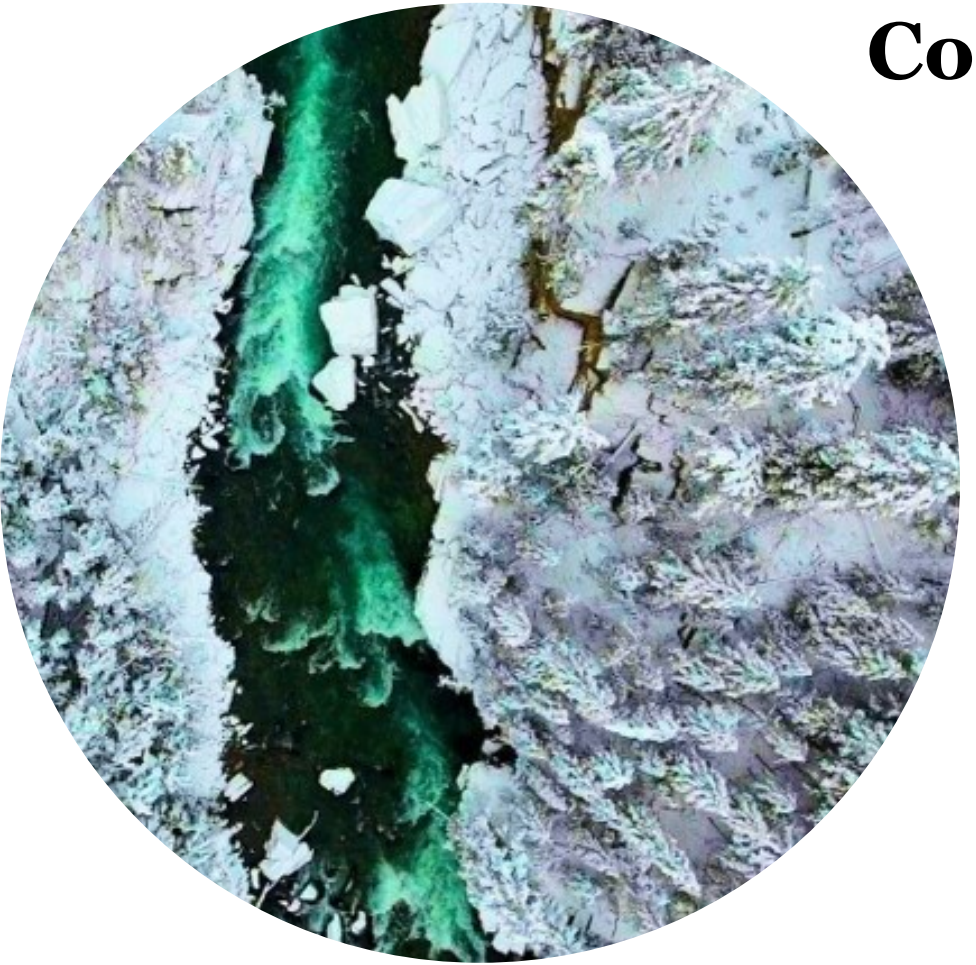
- If yes, proceed with the decomissioning plan
- If not, new decommissioning measure need to be chosen based on site-specific risk assessment prediction

Mine sites need to have a sufficient financial guarantee to:

1- conduct the monitoring

2- implement mitigation measures if required (i.e. pit backfill can be costly!)





Concluding statement

- Risk assessment models are essential for effective mine waste management throughout all stages of mining projects

- The challenge lies in the gatekeeping of this tool as project transitions from one proponent to another, or between different regulators (Provincial vs Federal)