Broad Environmental Impacts and Risks to Worker for the Remediation of an Abandoned Uranium Mine in Northern Saskatchewan

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SRC at a Glance

- Saskatchewan’s leading provider of applied RD&D and technology commercialization
- Over 400 employees
- >60 years of RD&D experience
- 1,800 clients in 24 countries around the world
SRC is managing the Cleanup of the Gunnar, Lorado and 35 Satellite Mine Sites in Northern Saskatchewan on behalf of the Provincial and Federal Governments.
Positive and Negative Impacts of Rehabilitation

Positive Impacts

• Reduction of risk to human health
• Reduction of risk to the environment
• Restoration of habitat and ecological services

Negative Impacts

• Emissions to the air water and soil
• Energy use
• Risks to site workers
Sustainable Remediation

“the practice of demonstrating, in terms of environmental, economic and social indicators, that the benefit of undertaking remediation is greater than its impact and that the optimum remediation solution is selected”… and implemented

(SURF UK, 2010 Sustainable Remediation Framework)
Case Study: Gunnar Mine Site
Study Objectives

1. Examine the broad environmental impacts of two remediation options being considered for the Site using a screening LCA approach

2. Estimate the risk to workers from civil engineering work and traveling to Site
Aspects of the Site Considered during this Study

Mine Pit

Waste Rock Piles

©Woodland Aerial Photography
Life Cycle Assessment

Inputs
- Raw material
- Energy

Outputs
- Emissions to air, water and soil
- Co-products
- Waste

System Boundary

- Resource extraction
- Production
- Distribution
- Use
- End-of-life

(Modified from http://www.ciraig.org/)

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Aspects of the Site Considered during this Study
**OPTION 1 – “Perpetual” water treatment**

- Camp operation
- Travel to site
- Pit perimeter reconfiguration
- Burying debris in waste rock deposit
- Diversion channel construction
- Revegetation of waste rock deposit
- Long-term monitoring
- Water treatment system constr.
- Long-term water treatment (100-500 yrs)

**OPTION 2 – Dewatering of the Pit**

- Water treatment system constr.
- Open pit dewatering (2 yrs)
- Ramp construction
- Placement of waste rock and debris into pit
- Camp operation
- Travel to site
- Filling pit to the rim with additional clean borrow
- Revegetation of waste rock footprint and pit
- Long-term monitoring (25 yr)
Overall environmental performance ranges widely and depends on assumed timeframe.
Option 1 (100 yr)

- Camp operation & workers' travel
- Pit perimeter regrading
- Revegetation
- Waste rock deposit cover
- Diversion channel construction
- Water pump & treat
- Long-term monitoring

Option 2

- Camp operation & workers' travel
- Ramp construction
- Revegetation
- Waste rock deposit
- Pit dewatering
Risk to Workers

1. Occupational health and safety risk from on-site activities
2. Risk of fatalities from air travel
Occupational Risk

- Occupational risk (lost hours) from life cycle activities (rehabilitation, travel to site, and long-term monitoring)

- Based on US Air Force Sustainable Remediation Tool (SRT)
Risk of Fatal Air Accidents

- Risk of fatal accident during air travel during rehabilitation and long-term monitoring
- Two types of flights considered
  - commercial airline
  - general aviation
## Risk to Site Workers – Results

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<thead>
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<td>Estimated lost hours (hr)</td>
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<tr>
<td>Rehabilitation</td>
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<td>80</td>
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<td>Long-term monitoring</td>
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<td>Total</td>
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Option 1: “Perpetual” water treatment

Option 2: Dewatering of the pit
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Valuable tools that:

- Support sustainable remediation initiatives with verifiable, transparent and quantitative information
- Guide decision-making
- Steer design and improvement efforts
- Extend common GHG emissions estimates to activities beyond activities at the site

Limitations and uncertainties
SRC’s Sustainable Remediation Services

- Tiered sustainability appraisal
- Multi-criteria analysis for decision support (e.g., Expert Choice®)
- Life cycle costing analysis
- Oral soil bioaccessibility tests
- Ecological toxicity tests (plants and invertebrates)
- Biodiversity footprint
- Life cycle assessment
Thank you