Case Study: Kemess South Mine Reclamation and Closure
(Development of a Risk-Based Remediation Plan)

NORTHERN LATITUDES MINE RECLAMATION WORKSHOP

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Agenda

1. Project Overview and Site Description
2. Site Screening and Investigation Process
3. Risk Assessment and Remedial Action Plan
4. Outcomes and Project Summary
Case Study – Essential Components

- **Project Scale**
  - Both the site itself and our overall scope

- **Integrated Framework**
  - Complex regulatory requirements and multi-phase approach

- **Risk-Based Remedial Plan**
  - Focused, site-specific

- **Successful Site Closure Strategy**
Site Location – near Mackenzie, BC
Site Setting – Core and Non-Core

- Project Scale
- Successful Contaminated Sites Strategy
- Integrated Framework
- Risk-Based Remedial Planning
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More than 14 km from one end of the site to the other – non-core areas numerous and distributed
The Mine Site – Regulatory Drivers

- BC Requirements – Mine Sites
  - Past - Ministry of Energy, Mines, and Petroleum Resources (MEMPR)
  - Now – MEMPR Environmental Management Act – Ministry of Environment (MOE) and MEMPR
  - Complete closure plan – core **AND** non-core areas
Remedial Plan – Risk-Based Approach

- Site Screening
- Site-Specific Risk Assessment
- Conceptual Site Model
- Site Investigation

Risk Based Remedial Planning

- Contaminated Sites Strategy
- Integrated Framework
- Project Scale

Risk-Based Remedial Planning

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- Contaminated Sites Strategy

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Risk-Based Remedial Planning

- Integrated Framework
- Project Scale
- Contaminated Sites Strategy
Site Screening

- Identify areas of environmental concern and associated contaminants of concern – screen all possible sources
Jet Fuel Storage

Site Screening
Risk Based Remedial Planning
Conceptual Site Model
Site-Specific Risk Assessment
Site Investigation
Warehouse Laydown and Storage Area
15 areas of potential environmental concern across the non-core lands
Conceptual Site Model

- Identify potential receptors and exposure pathways—focus the investigation program
Aquatic Receiving Environment

Kemess Creek adjacent to pumphouse
Integrate potential contaminant sources, pathways, and receptors

- Sources from Site Screening
- Release Mechanisms
- Transport Pathways
- Exposure Routes
- Receptors
Summary of Results
Site Investigation Objectives

- Characterize potential sources and migration potential – key elements of Risk Assessment
- Three major sources and pathways:
  1. Surface soil – soil ingestion and eco
  2. Sub-soil – soil ingestion, eco, and shallow groundwater
  3. Deep groundwater – eco, aquatic, and drinking water users
Phase 1 - Surface Soil

Site Screening
Risk Based Remedial Planning
Conceptual Site Model
Site Investigation
Site-Specific Risk Assessment
Site Screening
Phase 2 – Test Pits (Sub-Soil)

Note the staining in shallow soil.
Phase 3 - Groundwater

- Wells at worst-case locations – directly down-gradient of sources and/or adjacent to receptors
- Characterize flow, aquifer and identify contaminant migration potential
Phase 3 - Groundwater
Summary of Investigation Results

- 15 areas of **potential** environmental concern reduced to 10 **actual** areas of environmental concern
- Completed in short time (2 months)
- Limited resources required
- Met the objectives – data from targeted sources
Risk Assessment Strategy

- Identification of risk – incorporate Conceptual Site Model and investigation results
- Evaluate potential for adverse effects to human and ecological receptors – ten areas of concern
- Focus on future exposure during post-decommissioning activities
Human Receptors

- Future human users of the site – main driver for Risk Assessment and Remedial Plan
  - Environmental sources - more sensitive receptors
Ecological Receptors

- Site Screening
- Risk Based Remedial Planning
- Conceptual Site Model
- Site Investigation
- Site-Specific Risk Assessment
Summary of Potential Risk

- Ten areas of environmental concern reduced to four with unacceptable risk
  - Unacceptable risk to ecological receptors in soil for metals; shallow impacts
  - Acceptable risk to human health
- Mine site contamination was not considered extensive
Risk-Based Approach – Remedial Plan

- Site Screening
- Conceptual Site Model
- Site Investigation
- Site-Specific Risk Assessment
- Risk Based Remedial Planning
- Contaminated Sites Strategy
- Integrated Framework
- Project Scale
- Risk-Based Remedial Planning
Final step of the integrated strategy to address the non-core areas

Targeted remedial strategies for each of the four areas of environmental concern with potential risk

Based on **future** land use at the site
Remediation Strategy

- Soil contamination – shallow excavations
  - onsite disposal
- Further investigation
  - Stained soil, surface impacts, inaccessible buildings
Remediation Strategy

- Recommendations only at those areas with unacceptable risk to receptors
- Remediation methods tailored to site conditions and available resources
- Designed to meet MOE requirements for Non-Core areas
Successes of Our Approach

- Short time frame
  - Site Screening to RAP in 8 months
- Reduced cost to complete entire program
  - Four major tasks – significantly less than full-scale remediation
- Site-specific remedial options
- Risk-based RAP successfully integrated into Mine Closure Plan for core and non-core areas
  - Innovative alternative to “traditional” reclamation
Questions? Thank You!

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