Planning a Complex Mine Remediation
Objective

Discuss Giant Mine Remediation Project’s unique complexities

• History of Giant Mine
  – Jurisdictions
  – Stakeholders; interests

• Planning the Remediation
  – Care & Maintenance
  – Urgent Risk Mitigation
  – Interdependent Components
  – Contracting
History of Giant Mine

- Giant Mine operated 1948 to 1999
- Many owners
- Royal Oak Mines Inc. declared bankruptcy in 1999
- 846-hectare property in custody of Aboriginal Affairs and Northern Development Canada
Roasting process to extract gold produced 237,000 tonnes of arsenic dust as byproduct.
Jurisdictions

- Government of Canada
- Government of the Northwest Territories
- City of Yellowknife
- First Nations and Métis land claims
- Others
Giant Mine Stakeholders

Interests: varied; may be in competition; opposition

Engagement: constant; balances opposing views; keeps all informed
Managing Site and Planning Remediation

• Government of Canada’s priorities:
  – Ensure site safety/integrity
  – Maintain regulatory compliance
  – Maintain engagement with First Nation stakeholders

• Care and Maintenance:
  – Water management and treatment
  – Inspection and maintenance of underground infrastructure, notably arsenic bulkheads
  – Dust suppression
  – Site security
Managing Site and Planning Remediation

- December 2007: Type A Water License application to Mackenzie Valley Land and Water Board to start remediation
- March 2008: Project referred to Environmental Assessment (EA)
- August 2014: EA completed; final Report of EA accepted by Ministers
- 2007-2014: Remediation Plan activities suspended
  - Significant challenges: deteriorating infrastructure; emerging risks; public safety
Managing Site and Planning Remediation

Managing onsite emerging risks within Regulatory Framework

• During EA:
  – onsite conditions continued to worsen
  – risks to public safety and to the environment apparent

• Emergency water license to mitigate risks:
  – Roaster complex deconstruction
  – Underground stability
2006 Baker Creek Realignment
2011 JoJo Lake Tailings Cap
2013-2015 Roaster Complex Deconstruction
Baker Creek Flood Risk: C1 Pit Buttress
Effluent Treatment Plant Tank Improvements
Underground Stability: Stope Backfilling
C-Shaft Head Frame Deconstruction
Managing Site and Planning Remediation

• Giant Mine Team continues to manage risks: underground; surface
• EA report: 26 measures to address as part of the remediation process
• Measures affecting remediation project:
  – Realignment of Baker Creek
  – Tailings rehabilitation
  – Effluent treatment
  – Surface water quality
  – Freeze Program
Remediation Components

• Infrastructure Deconstruction and Disposal
• Surface Water Management
• Tailings Rehabilitation
• Openings to Surface
• Contaminated Soil
• Open Pits
• Borrow/Quarry Development
• Underground Stabilization

• Freeze Program
• Baker Creek Realignment
• New Effluent Treatment Plant
• Common Site Infrastructure
Infrastructure Deconstruction and Disposal

On-site waste streams:
• 60,000 m³ non-hazardous building waste
• 16,000 m³ arsenic trioxide waste
• 7,000 m³ hazardous (non-arsenic) waste

Waste Disposal:
• Non-hazardous waste – on-site landfill or recycled
• Arsenic trioxide waste – underground within the freeze zone
• Hazardous Waste – off-site at licensed facility
Surface Water Management

- Construction of drainage channels, storage ponds and spillways to direct surface water into Baker Creek
- Baker Creek discharge must meet site specific water quality objectives
Tailings Rehabilitation

- 95 hectares of tailings: variable depth; quality
- Tailings cap requirements: informed by engagement process
- Graded to promote drainage of clean surface water
Openings to Surface

- 37 mine openings to surface
- Adits, raises, shaft, portals, stope breakthroughs
- Capping achieved by engineered concrete caps or rock fill
Contaminated Soil

- Arsenic contaminated material: 900,000 m³; waste rock; disturbed soils

- Petroleum hydrocarbon-contaminated soil: 3000 m³
Open Pits

- Eight open pits
- B1 Pit will be backfilled to support freeze solution
- Open pit closure remediation under discussion after EA Report
Borrow/Quarry Development

- Borrow material needed for contaminated soil cover, tailings cap, and landfill cover
- Estimated fine-grained soil needed: 950,000 m³
- Estimated coarse-grained needed: 1,150,000 m³
Underground Stabilization

- Objectives:
  - Maintain ground surface
  - Maintain Baker Creek
  - Ensure stability around arsenic trioxide stopes and chambers

- Backfilling near surface stopes, voids: 400,000 m³

- Investigations on-going; confirming scope of stabilization activities

- Stabilization requirements highly dependent on final mine water level
Freeze Program

- Four freeze areas for 13 arsenic containing stopes and chambers
- 60,000 m of drilling to support thermosyphon installation
- Freeze Optimization Study (FOS) built in 2010 to better define design parameters
Yellowknife office building vs. frozen chamber
Arsenic trioxide storage areas to freeze
Baker Creek Realignment

- Poor hydraulic capacity; high seasonal flow variability
- Fish habitat
- Historic tailings and contaminated sediments
- Potential risk of flooding underground workings
- Realignment being reviewed after EA Report
New Effluent Treatment Plant

- Arsenic removed by iron co-precipitation and adsorptive technology; meets Canadian Drinking Water Quality guidelines

- Year-round operation; near-shore outfall into Yellowknife Bay

- Replaces existing seasonal plant treating to Metal Mining Effluent Regulations
# Giant Mine Remediation Plan

1. Chamber Freezing & U/G Works
2. Pits, Baker Creek & Tailings Covers
3. Infrastructure Deconstruction
4. Long Term Water Treatment

2002 Air Photograph
Interdependent Remediation Components

- Baker Creek
- Open Pit Closure
- Surface Water Drainage
- Freeze Program
Interdependent Remediation Components

- Underground Stabilization
- Tailings Rehabilitation
- Contaminated Surface Material
- Borrow Requirements
- Surface Water Drainage
- Effluent Treatment
Interdependent Remediation Components

- As$_2$O$_3$ Waste Disposal
- Effluent Treatment
- Underground Stabilization
- Open Pit Closure
- Tailings Rehabilitation
Government of Canada Contracting Priorities

• Open, fair, transparent procurement
• Establish a clear understanding of the government procurement process;
• Maximize competition and obtain value for money;
• Consult with Industry to solicit ideas and recommendations for consideration in the development of specific procurement strategies;
• Assess market capacity; and
• Maximize aboriginal participation in accordance with Land Claim obligations
Government of Canada Contracting

- Treasury Board Contracting Policy
  - Approval Thresholds
- Trade Agreements
  - 44 Trade Agreements with 39 countries
- Aboriginal Land Claims
  - Tlicho Comprehensive Land Claim Agreement; the *Môwhì Gogha Dè Nîïtâêê area*, extends into the Giant Mine lease boundary
  - Asserted claim by Yellowknives Dene First Nation
- Other Considerations
  - Established Real Property contracting tools
Planning A Complex Mine Remediation - Summary

- Multiple stakeholders and jurisdictional interests
- Remediation planning with deteriorating site conditions
- Interdependent remediation elements
- Federal government procurement policies
Planning a Complex Mine Remediation

Questions?