2015 RPIC Federal Contaminated Sites Regional Workshop

Giant Mine Remediation – The First Phase
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Giant Mine

- Gold mine located 5 km north of Yellowknife, NWT
- Operational from 1948 to 2004
- Aboriginal Affairs and Northern Development Canada (AANDC) currently owns the mine
- Currently on Care and Maintenance

- Remediation Work On-going
  - Decontamination/decommissioning of select mine infrastructure
  - Stabilization
Site Map
Major Concerns

- Crown pillar potential failure
- Arsenic tri-oxide stopes potential failure
- Subsidence (sinkholes) around open pits and public highways
- Dust from tailings ponds
- Surface water and dust interactions
Solutions?

- Backfill.....
  - The problems seen underground are due to a lack of backfill which creates potential for the large void spaces to collapse in on themselves.

- So what’s next?
  - Multiple types of backfill are available.
  - Not enough rock or aggregate for CRF/CAF and access underground is limited.
  - Hydraulic fill is uncontrollable.

- Paste backfill!
  - Tailings are available as feed material.
  - Remote pumping is possible to inaccessible areas.
  - Control over slump and flow makes paste “trainable.”
Major Complications

- Baker Creek flows through the entire property and around the pits
- Tailings are far from the areas requiring fill
- Public is in close proximity (from an old highway as well as the city itself)
- Underground access is limited
- Surface space for set-up is limited
- Require multiple pour locations with varying volume requirements
- Work to be done immediately (no time to wait for permanent plant)

Mobile Paste Backfill
Main Elements of Backfill Plan

- Excavate tailings and stockpile near B1 pit
- Drill surface backfill, paste delivery, monitoring, breather boreholes
- Rehabilitate underground ground control system
- Drill underground backfill, inspection, monitoring, breather boreholes
- Install underground paste delivery piping system
- Construct underground fill barricades and install cameras
- Produce paste and pump underground to backfill voids
Inset – Main Ore Pass on 2nd Level

- Underground paste delivery pipe
- Conventional barricade
- Contingency barricade
- Sub-vertical primary fill delivery surface hole
- U/G monitoring camera installed in-person
- Borehole camera monitoring / secondary paste fill hole(s)
- Borehole low slump or foam barricade
Project Objective

- Field Testing
  - Develop suitable backfill recipe designs
  - Design methodology for remote barricades
  - Test system performance

- Paste Backfill Production
  - Backfill the B1-18 stope complex
    - Prevent water ingress into u/g
    - Inhibit propagation of the sinkhole
    - Stabilize the 1-18 complex
    - Test out methodologies for future work
Paste Backfill Stats

- Paste delivery through 13 holes
  - 12 delivery boreholes (8”) and 1 observation borehole (4”)
  - Production area at the edge of the B1 pit
  - 2 Mixer trucks, positive displacement pump, cement silos, water tanks

- 10,667 m³ pumped underground in ~ 2 months (Oct 21 to Dec 16)
- 12 different paste recipes
  - Tailings, NPC, heated water, aggregate (for barricades)
Paste Backfill Underground
Backfill Stats

- High slump, low cement content recipes for bulk fill
- Low slump highly cemented recipes for paste barricades
  - With and without aggregate

- Camera monitoring
  - Surface monitoring – 3 borehole cameras
  - U/G monitoring – remote, up to 8 cameras at one time

- U/G monitoring
  - Morning walk through
UCS stats

118-03 Fill Profile

0 100 200 300 400 500

Strength (kPa)

Apr 30, 2015
QA/QC

- Daily slump tests
  - 2 per hour per truck

- Daily casting of cylinders – unconfined compressive strength (UCS)
  - On-site laboratory
  - 1, 3, 7, 28 day curing times
  - 129 x 12 cylinders = 1548 cylinder breaks

- Calibration checks of equipment

- Daily monitoring and reporting
  - Volumes, temperatures, moisture contents
Challenges

- Unknown underground workings
  - CMS / volume estimates
  - Underground inspections daily
  - Fluctuating daily sequencing plans

- Congested Site
  - Placement of equipment
  - Traffic control
  - H&S controls for movement around site
    - Flagging and pilons
Challenges – Contaminants

- Arsenic and Silica

Mitigation Measures
- Environmental protection
  - Lining daily stockpile, production area and piping routes
  - Truck cleaning, “dirty” gear storage, bringing excess tailings back to the tailings areas at end of day
- PPE
  - Tyvek suits to protect against dust
  - Respirators for silica dust control
- Air monitoring
  - Dust and particulates
Challenges – Winter Operation

- Paste Production
  - Heated water
  - Indoor tailings storage
  - Overnight heating of equipment
  - Heating of equipment during production
  - Tents for camera monitoring and slump testing
  - Lighting plan

- Personnel – H&S
  - Winter safety gear
  - Frequent breaks (with coffee and donuts)
  - Team work
THANK YOU