The Rehabilitation of Ontario’s Kam Kotia Mine: An Abandoned Acid Generating Tailings Site

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WHAT IS KAM KOTIA?

- Kam Kotia is a former Cu/Zn mine near Timmins, Ontario
- There are about 6 million tonnes of unmanaged acid generating tailings covering more than 500 ha
- Environmental impacts are locally significant
  - acidic leachate
  - dusting
  - aesthetics
  - physical safety

MINING HISTORY

- Principle exploration 1926-1928, exploration shaft
- Mining * 1943-1944 - 169,000 tonnes open pit
- Mining 1961-1972 - 5,840,000 tonnes, mainly underground
- Production 6.6 MT @ 1.1% Cu, 1.17% Zn, 0.10 oz/Ag

HYDROLOGY

- North and East seeps, with a pH of 2-3, drain NUT, east half of NIT and north half of plant site to the Kamiskotia River in the north.

- South seep drains SUT, south half of NIT and plant site to Little Kamiskotia River in the south, which had a pH of 3.5 to 4 prior to rehabilitation beginning on the site.

BACKGROUND

- The total rehabilitation of the abandoned Kam Kotia Mine site is to be conducted as a proposed five-phase program.
- This rehabilitation plan was developed during fiscal 2000/01, and predicted a total rehabilitation cost of more than $41 million.
- The cost estimates were as follows, including a 30% contingency:
  - Phase “A”: $4.985 million
  - Phase “B”: $3.285 million
  - Phase “C”: $8.190 million
  - Phase “D”: $3.372 million
  - Phase “E”: $11.766 million
  - Effluent treatment for 50 years: $9.698 million

PHASES “A” AND “B”

- In the fall of 2000, a funding commitment for $9.0 million was made to conduct Phases “A” and “B”.
- This money was to come from the $20 million available during the last two years of the original 4-year Abandoned Mines Rehabilitation Fund.

PHASE “A”

- Phase “A” involved the construction of a Lime Addition Treatment Plant, as well as all of its required infrastructure, and the construction of a new NUT impoundment dam structure.
- The combined cost of these Phase “A” bids was $9.85 million, and the work was completed by July 2002.
- Realized that the combined costs of Phases “A” and “B” would approach $14 million.
• Phase “B” involved the relocation of the SUT tailings to within the new NUT impoundment area.

• Upon completion of the work, more than 340,000 m$^3$ of SUT tailings had been relocated and buffered with Envirolime, at a cost of $3.4$ million.

• Phase “B” work was completed by mid-March 2003.
PHASE “B”

- The bid prices for the Phase “B” work resulted in a cost overrun of $142,991.26 over the total amount available for Phases “A” and “B”.
- Savings were attained by having the contractor reduce the total area of clearing and grubbing required and by cancelling the seeding of the SUT area after the removal of the tailings.
- Although seeding was not done, agricultural lime was still spread over the peat/soil surface to buffer residual acidity.
- The final cost of Phases “A” and “B” was 4,111.88 below the expenditure cap.

PHASE “C”

- Phase “C” involved the relocation of the NUT tailings to within the new NUT impoundment area.
- Upon completion of the work, more than 611,000 m$^3$ of NUT tailings had been relocated and buffered with Envirolime, at a cost of $6.9 million.
- The Phase “C” work was completed by late-March, 2004.
However.....

.... in abandoned mine rehabilitation, like any construction project, ....

Things don’t always go exactly as planned!

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Contaminated NUT Area Water

• Timmins received two years of anomalously high precipitation.
• The NUT Impoundment Area filled with 500,000 to 700,000 m$^3$ of water at a pH of about 2.8, and containing very high acidity and metals.
• In order not to delay the project, a decision was made to stack the NUT tailings in the impoundment area during Phase “C”.

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Contaminated NUT Area Water

• Efforts were made to conduct the “in-situ” treatment of the NUT “Pond” during the winter of 2003/04.
• 706 tonnes of lime were added to the Pond, followed by over 2,000 tonnes of caustic (e.g. NaOH).
• Managed to raise the pH sufficiently to allow the discharge of the contaminated water for ~ 3 hours.
• Eventually ceased the treatment after having spent $1.8 million.

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Contaminated NUT Area Water

• A contract was awarded earlier this year to conduct the treatment and discharge of the contaminated NUT water and to place the stacked NUT tailings into their proper location.
• The work is currently being conducted.
• The treatment method is based on the recommendations of a consultant that studied the various ways to deal with this water, and involves neutralization with caustic and filtering of the resulting sludge using geotextile bags.
• The final cost of this contract will be over $9.0 million.
The NIT area “dry” cover was to have been built as part of Phase “E”.

In order for the KKM rehabilitation work to continue, the first two layers of that cover – the capillary break – were constructed during the winter of 2004/05, at a cost of $3.4 million.
Miscellaneous Rehabilitation

- The first partnership project between MNDM and the OMA (the Ontario Mining Association) was conducted on the Kam Kotia Mine site during the fall of 2003.
- The project involved the vegetation of the NUT impoundment dam structures, which had been deleted as a cost saving measure during Phase “A”.
- The project cost of $276,000 was shared equally between the two partners.

Rehabilitation Yet To Be Done ...

- Complete the NIT cover – this work is expected to cost more than $10 million, so it will have to be conducted during two separate fiscal years.
- Collect the remainder of the unimpounded tailings.
- Conduct Phase “D”, which involves the construction of the “moist” cover over the NUT impoundment area.
- Conduct the remainder of Phase “E”, which will include the rehabilitation of the open pit and all of the physical hazards on the site, such as the shaft and the thin crown pillar.

The final cost for the rehabilitation of the Kam Kotia Mine site is now expected to be in the range of $55 million.

Recommendations

(aka – What would I have done differently?)

If you are planning on undertaking an abandoned mine rehabilitation project of a similar size and scope:

1. Try to diversify your funding sources by involving other governments, agencies or partnerships:
   - MNDM was unsuccessful when it approached the Federal government for assistance.
   - The OMA partnered with MNDM on the revegetation of the NUT impoundment dams.
Recommendations (cont’d)

2. Build a “contingency” allowance into your bids so that you can deal with the unforeseen – a 50% cost increase is not unusual:
   - The latest RFT for the treatment and discharge of the contaminated NUT water had a contingency allowance of $250,000 built into the bid forms.
   - The bidders each show what their mark-up percentage will be on that contingency allowance.
   - The cost of that contingency [e.g. contingency + (contingency x mark-up)] becomes part of the contractor’s total bid price.

Recommendations (cont’d)

3. Once you start a rehabilitation project it’s hard to “back off”. Be prepared to stay the course:
   - The five-phased approach at Kam Kotia was supposed to have allowed MNDM to end or pause the project after any phase, with no loss of the benefits already achieved.
   - In reality, discontinuing rehabilitation on an environmental project like Kam Kotia will probably draw the negative attention of the environmental regulators, environmental NGOs, and/or the public.

Recommendations (cont’d)

4. Be prepared to “think outside of the box”.
5. Expect the unexpected.
6. We live in Canada! Weather will probably have a negative impact on your project at some point!!
7. Have fun with your projects. Remember that you are making things better.