Memorandum of Understanding

The Environmental Protection Division of Renewable Resources and Royal Oak Mines Inc. agree to jointly develop and cost share a study to develop computer dispersion modelling of sulphur dioxide and arsenic emissions from the Royal Oak Giant Yellowknife Mine as specified in the Terms of Reference.

The Terms of Reference #94-XX dated August XX, 1994 are accepted and contract shall be jointly reviewed and administered by a member from the two groups. The two members are Jim Sparling, Air Quality Specialist, Environmental Protection Division and Dave Anthony, Manager, Environmental Services, Royal Oak Mines Inc..

The costs will be divided equally and billing for the Royal Oak Mine portion will be sent directly to the company for payment.

The project shall be completed by December 31, 1994. check This

Emery Paquin
Director
Environmental Protection Division

Kevin Weston
General Manager
Yellowknife Division
Royal Oak Mines Inc.

Royal Oak Giant Yellowknife Mine **August 1994**

Atmospheric Emmission Dispersion Modelling Study

Terms of Reference

Purpose: Dispersion modelling is required to predict (characterize) ambient concentrations of sulphur dioxide and arsenic trioxide in the Yellowknife area which result from emmissions from the Giant Yellowknife Mine roaster. The modelling results will be used to determine what options could be taken at the mine to reduce ambient concentrations and frequency of guideline exceedences.

Background: The ambient concentration of sulphur dioxide in Yellowknife is believed to exceed the one hour guideline of 450 ug/m^3 less than 1% of the time. The primary source of sulphur dioxide in the Yellowknife area is the roaster stack at the Giant Mine. Other sources of SO_2 include home furnaces and vehicles.

The Giant Mine roaster exhaust gas is cooled and scrubbed to remove arsenic by Cottrell precipitators and a baghouse, prior to being released. The exhaust stack is 45.70 m tall x 2.70 m diameter. Exhaust gas temperature is on the order of 90 ^{o}C.

Great Slave Lake is located to the immediate south of the mine. This body of water is known to influence dispersion.

Options: i) Increased Dispersion: Consideration should be given to increasing the exhaust gas temperature, velocity or stack height. Velocity can be increased by reducing the stack diameter or increasing exhaust gas volume. Gas volume can be increased by adding outside air to the exhaust stream, or increasing gas temperature.

ii)Contaminant Removal: Approximately 30 tons/day SO_2 is exhausted from the Giant Mine. Collection of this material would yield up to 15 tons/day sulphur to weak sulphuric acid. This option may not have technical or economic feasibility. Further consideration of this option will not be made at this time.

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Schedule of Work:

Sensitivity Analysis - Dispersion Modelling

i) Control sample; no changes in parameters
ii) Increase stack height by 10, 25, 50, 75, 100%
iii) Increase gas velocity by 10, 25, 50, 75, 100%
iv) Increase gas temperature by 10, 25, 50 C^0
v) Increase stack height by 10%, gas velocity by 10, 25, 50, 75, 100%
vi) Increase stack height by 25%, gas velocity by 10, 25, 50, 75, 100%
vii) Increase stack height by 10%, gas temperature by 10, 25, 50 C^0
viii) Increase stack height by 25%, gas temperature by 10, 25, 50 C^0

Cost Estimation

Review results of the sensitivity analysis above, with the client. Develop preliminary cost estimates (+/- 50%) for the alternatives which appear to produce the most cost effective results. Develop feasibility cost estimates (+/-30%) for the three alternatives which appear to be the most likely to receive further consideration.

Required Inputs:

Meteorological input files based on AES data collected at Yellowknife airport, which is 2 km from the Giant minesite.

Topographic input files for a 10 km x 10 km grid of the Yellowknife area.

Calculations from an *approved* dispersion model.

Timing: The work is expected to proceed during the ~~1st~~ 4th quarter of 199~~5~~4