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June 20, 1979

Mr. Glen Warner,
Chairman,
N.W.T. Water Board,
P.O. Box 1500,
YELLOWKNIFE, Northwest Territories.

Gentlemen:

Re: Water Licence No. NIL3-0043
Subject: Reports

Part C, Item 14

12 Month Progress Report on Proposals to Meet Final Effluent Quality Requirements

The preliminary proposal dated July 13, 1979 stated that five different areas would be examined, i.e.,

- a) Cyanide distribution loop
- b) HSA reactor
- c) Automatic pH control
- d) Change roaster conditions
- e) Centrifuge cottrell dust slurry

a) Cyanide Distribution Loop

This improved feeding system has been installed and has resulted in a reduction of 10% in cyanide consumption.

It is too early yet to tell from the Surveillance Network samples what differences this has made in the final tailings effluent.

b) HSA Reactor

A purchase order to HSA Reactors Ltd. dated December 13, 1978 (see copy enclosed) stated that the on-site pilot plant test would begin in April 1979. Our latest advise from HSA is that the equipment will arrive in late June 1979. The delay was necessary because of modifications that were made after the in-plant pilot test at Pamour Porcupine Mines last September-November 1978.

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It is expected that the test at Giant will take three months. Assessment of results and final reports will take three months. If Giant is happy with the results and orders a commercial sized unit, design, construction and delivery could take six to nine months. Hence we may not have the commercial unit working until mid-September 1980.

We have been unable to get copies of the Pamour test although we understand that the results are very successful.

c) Automatic pH Control

A purchase order has been issued for this control system (see copy attached). This will allow more effective use of lime and cyanide and will lower cyanide consumption. This has been the result of a similar installation at Con.

d) Arsenic Upgrading System

To replace the other two areas that we had mentioned in the preliminary report, we are now designing and pilot-plant testing a process to leach the soluble arsenic from three different products:

- our baghouse dust
- our cottrell dust
- Con's arsenic storage pond material

The saturated solution will be separated from any insoluble matter and then sent to the crystallizers where a 99% plus As_2O_3 crystallized product will be produced for an American market.

It is hoped that by the end of July the pilot plant work will be completed and the design parameters established. Then we can place orders for the equipment and prepare the building for occupancy. Our test team has only returned from a week in Struthers Wells laboratories in Warren, Pennsylvania putting some Giant baghouse dust leach product through a pilot plant sized vacuum crystallizer to produce 153 lbs. of 99.9% As_2O_3 crystals.

We have been told that we could expect to have the crystallizers on site in 12 months. Hopefully, the balance of the equipment will be delivered in 12 months or less.

In General

The two main areas that we are focusing on are the HSA Reactor to remove the cyanide and heavy metals from the tailings effluent; and the

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new arsenic upgrading system to remove the soluble arsenic from the effluent. These methods will provide us with the best chance for success in meeting the final effluent quality requirements outlined in Part C, Item 14.

To Summarize

1. Tests on 250 gallons of 'barren bleed' have shown that the heavy metals (copper, nickel, zinc) can be removed successfully to the point where the cyanide solution can be recirculated and re-used.

<u>Constituents</u>	<u>Before Treatment (Mg/Litre)</u>	<u>After Treatment (Mg/Litre)</u>
copper	630	36
nickel	14.2	0.8
zinc	13	1

2. Tests on Cottrell dust have shown that 100% of the soluble arsenic is removed by the hot water leach method, and that the resultant effluent from the mill would analyze in total arsenic .5 mg/litre compared to 15 at present. However, it must be emphasized that in the tailings pond now are many tons of leachable arsenic, and until this is covered with several feet of insoluble material, the final effluent to Baker Creek will analyze higher than 0.5 mg/litre.

3. Total Cyanide would be reduced from the present level of 0.5 mg/l of 15 ppm to .5 ppm.

4. Time Schedule

- a) Cyanide, heavy metals (HSA Reactor)
 - operating by September 1980
- b) Soluble arsenic removal (Arsenic Upgrading System)
 - operating by July 1980

5. Sludge or Precipitate Produced

- a) Cyanide
 - negligible
- b) Heavy metals
 - approximately 91 lb/day copper
 - approximately 70 lb/day zinc
 - approximately 50 lb/day nickel
- c) Arsenic (insoluble)
 - approximately 3 tons/day, most of which would be from the Con material.

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6. Description of the Process Involved

a) HSA Réactor

It was necessary to sign a secrecy agreement with HSA in order to get them to agree to send a unit to Giant.

To quote their proposal to send a unit to Giant, "The heart of the HSA System is an electrochemical reactor which has a very large mass transfer capability and some unique electrochemical properties."

We cannot disclose anything further.

b) Arsenic Upgrading

Since the flowsheet and selection of equipment are not yet decided, it is not possible to disclose the final process. But this will be determined shortly.

To Conclude

It is the resolved intention of the Company to meet the May 1980 deadline for the final report on the progress made toward reaching the Final Effluent Quality Requirements.

The former Minister's comments about the DPAT project results are understandable from one who is remote from the scene.

In actual fact, however, the DPAT project demonstrated that the cyanide level could be reduced to an acceptable level using $Cl_2/CN_T = 5:1$. The treated effluent is lethal to rainbow trout and residual chlorine is the suspected culprit.

To remove the soluble arsenic ferric sulphate was used in a ratio of Fe:As of 4:1. The stability of the resultant precipitate was not established. If there is any change of pH some of the arsenic will go into the solution. Attempts to fix or consolidate this sludge by Krofchak were not all that successful.

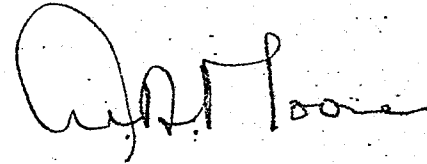
Regardless of the cost, neither of the two schemes was entirely satisfactory from an environmental point of view.

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As far as the former Minister's implied threat to take court action or levy fines, if the Company failed to meet the deadline, anyone familiar with the situation knows that this Company has been and is sincerely and diligently working towards a solution or solutions to the problems, and if our progress at times appears to have been slow, it is because the technology in our opinion has not been sufficiently developed.

Yours very truly,
GIANT YELLOWKNIFE MINES LIMITED

A handwritten signature in dark ink, appearing to read 'W. A. Moore', written in a cursive style.

W. A. Moore
General Manager

WAM:jc
Enclosures

c.c. D.J. Emery
L.S. Price
K.S. Morton

Early in 1975 (before issuance of the present water licence) Cominco commenced in-house studies on ways and means to permanently contain the Con and Negus arsenic oxide storage basins. The two main methods investigated were:

1. Covering the storage areas with waste rock from the mine, then covering the rock with soil and planting vegetation. This method was discarded when it became obvious that the rock was of greater density than the arsenic oxide sludge and that in fact the sludge would "float" to the top.
2. Concreting or shotcrete over the surface of the storage areas was investigated. This method was discarded because of support difficulties, serious doubt about the long term stability of the covering and because of the anticipated very high cost.

In 1977 Reid Crowther and Associates, Consulting Engineers, were engaged by Cominco to study the problem and recommend solutions. Four parameters were stressed for any solution; (a) permanency, (b) economics, (c) process feasibility, and (d) time constraints. Reid Crowther carried out studies on several possible means including chemical fixation of the arsenic oxide; physical coating of the arsenic trioxide; recovery and refining arsenic oxide to a marketable purity, and a more sophisticated method of permanently covering the arsenic basins and keeping them permanently frozen in situ.

In early 1978 Cominco made a presentation to the Water Board discussing these studies and the programme for further work. The chemical fixation and physical coating methods were rejected because they met none of the four parameters. Recovery and refining was attractive but at that time Cominco could not see an environmentally clean way of reclaiming the sludge.

The in situ method was chosen for further study and Cominco engaged acknowledged permafrost and soils experts, EBA Engineering Consultants Ltd., to do further research into this method. Freezing was eliminated when it was found that the rock temperatures at the bottom of the basins was above 0°C. Artificial freezing was studied and discarded as a solution. A method of covering the basins with membranes and then loading the membranes with sand or tailings was studied. The idea was to squeeze out the water contained in the sludge so that the sludge would develop sufficient bearing strength to carry a cover of sand, tailings, soil and vegetation. At this point, late in 1978, a further presentation was made to the Water Board describing these latest developments.

Early in 1979 Giant Yellowknife Mines Limited advised Cominco that it was developing the technology to refine the dust from their bag-house up to high purity arsenic trioxide and that they would be interested in treating Con's arsenic oxide sludge in their plant. At the rate indicated by Giant it would take approximately ten years to clean out the Con and Negus storage basins. As mentioned before this method is very attractive and studies were initiated with respect to reclaiming the sludge and transporting it from the Con property to Giant. Work to date suggests that using the Marconoflow technique to reclaim during the "above freezing" months is both practical and economical. Mechanical excavation of the sludge would be required when temperatures were below freezing. The reclaimed sludge would be pumped into a storage tank adjacent to the arsenic basin, then pumped into a special tank truck for delivery to Giant. At Giant the sludge would be pumped into a storage tank. It is estimated that only one truck per day would be moved through the City of Yellowknife to Giant. It should also be mentioned that Giant will have equipment capable of cleaning up any spilled sludge which might result from an unlikely accident. This equipment will be available to Cominco should it be necessary.

The date on which Cominco could start this reclamation method depends largely on when the Giant plant will be ready for full scale operation and of course upon the approval of the Water Board. Cominco feels that this method is by far the best in that all the arsenic oxide stored on surface will ultimately be reclaimed and that the risk of arsenic pollution from this material will be removed for all time. Cominco will be requesting the Board's approval in the near future.

21. In accordance with Part C, Item 21 of the Water Licence NIL-30040 a program to satisfy the "Terms of Reference for Studies Related to Restoration and Reclamation of Abandoned and Existing Tailings Areas" at the Cominco Ltd., Con Mine was submitted for approval and initiated on May 31, 1977. Laboratory and field investigations in progress since 1974 and prior to issuance of the Water Licence were incorporated into the program. Studies were conducted under the direction of the Cominco Ltd. Environmental Control function centered in Trail, B.C. with the approval and support of Con Mine management.

In December 1978, a report was filed in compliance with Part C, Item 21 of the aforementioned Water Licence as an interim progress report of study results to the end of the 1978 growing season. A copy of the 1978 progress report has been submitted to the Board. A detailed report of results to the end of the 1979 growing season will be submitted to the Board by January 1, 1980.