

Memorandum

To: Bill Heath
From: Larry Connell
Date: December 20, 1993
Subject: Accuracy of Environmental Analysis for Arsenic

On December 15th a meeting was held at the Giant mine between D.I.A.N.D. and Royal Oak staff to discuss the accuracy of the analytical results being generated by the environmental lab at the Giant mine. In attendance were:

D.I.A.N.D.:

Erik Madsen - Industrial Coordinator for Water Resources
Dave Jessiman - Water License Inspector
Kathleen Puznicki - Environmental Chemist

Royal Oak:

Keidock Kim
Paul O'Hara
Doug Johnson
Larry Connell

Over the past several years there has been a growing body of evidence that the Giant environmental lab consistently reports arsenic concentrations that are well below those measured by D.I.A.N.D.'s environmental lab. The Giant lab, however, does check well when assaying synthetic standards sent out by the D.I.A.N.D. environmental lab.

The problem is believed to stem from an antimony interference that affects the SDDC (Silver Diethyldithiocarbamate) method used at the Giant lab to analyze arsenic in water samples. Antimony is present in water samples from the Giant mine but would not be present in the standards prepared by the D.I.A.N.D. environmental lab.

The solution to this problem lies in converting to an alternate analytical method for the analysis of arsenic. The method of choice is the use of atomic adsorption spectrometry to determine arsenic concentrations by converting the arsenic to a hydride using sodium borohydride. Conversion to this method at the Giant environmental lab can be achieved by one of two options:

- A) Purchase of a commercial Hydride generation package to be installed on one of the existing atomic adsorption spectrophotometers at Giant. Estimated cost of the commercial package is \$6,500 plus an additional \$3,500 for the additional ancillary equipment.

- B) Fabrication of our own arsine hydride generation equipment following the procedures used at the Con Mine. The majority of the equipment required for this conversion was purchased by Giant in 1992 in anticipation of making this change. The equipment includes a multi head peristaltic pump, a four position magnetic stirring base and the associated hydride generation glassware. The remaining equipment to be purchased includes:

- Argon and hydrogen gas bottles with the appropriate regulators, hoses and adaptors.

The Giant assay lab currently has two Atomic Adsorption Spectrophotometers in service. One unit is dedicated to the analysis of gold using a Ketone extraction method while the other has multiple lamps set up for the determination of metals using an air acetylene gas mix. There is a third AA unit that is not in service that originated with the TRP.

In converting from the SDDC method to the Arsine Hydride generation method for arsenic analysis we can either use one of the existing AA units or set up the third unit as a dedicated instrument for arsenic. In using one of the existing units it will be necessary to set up the gas supply so that the AA unit can be switched easily between an air-acetylene flame and an argon-hydrogen flame. It would be preferable to set up the third AA unit as a dedicated instrument for arsenic determination. This would lead to less chance of contamination and error resulting from switching fuel sources. The spare AA unit will require servicing at an estimated cost of \$3,000 to \$5,000 before being placed in service. The biggest portion of this cost is time and travel costs for the service call to Yellowknife by a Varian Canada technician.

At the meeting a time schedule was agreed to for implementation of the conversion of the analytical procedure for arsenic:

January:

Paul O'Hara

- Purchase remaining equipment.
- Install AA unit and gas piping.
- Arrange for Varian Canada to service the AA unit.

1st Week in February:

Doug Johnson

- Set up Equipment and conduct test runs of the new procedure.
- Train the Giant environmental analyst in the procedure.

February & March:

Paul O'Hara
Vi Lau

Begin round robin testing with the
D.I.A.N.D. environmental lab and Chemex
labs in Calgary.

Quality Assurance

There is also evidence that the Giant environmental lab consistently reads low on nickel and copper analysis. While the variance is not as great as in the case of arsenic it does point to a systemic problem with the quality of results generated by our lab. The methods used to determine both nickel and copper concentrations should produce acceptable results. Our failure to achieve accurate results points to a need to improve implementation of our quality assurance programs.

We currently use field blanks, replicate sampling, and commercial standard solutions but do not use the appropriate statistical methods to monitor and verify our results. These procedures are required under our written quality assurance program for both the Giant and Colomac water use licenses.

I believe that our problem lies in the weak technical training of our analytical staff in statistical quality assurance procedures. This will have to be rectified by training as soon as possible.

We need to assure ourselves of the accuracy of our environmental analysis by implementing the quality assurance programs or we run the risk of having to analyze a growing number of the water samples from both the Giant and Colomac properties at commercial laboratories.

cc: E. Madsen
K. Kim

P. O'Hara
D. Johnson

