

MEMO

To: K. Blower

Date: Aug 27, 1987

From: K. Morton

Subject: Arsenic Fuming Pilot Test

Dr. Michael Chalkley

Summary

Recent feasibility examinations have indicated very good potential returns from an arsenic recovery/upgrading plant capable of producing up to 10,000 stpy of high grade arsenic trioxide. In order to take full advantage of the opportunities presented, we will have to penetrate an arsenic market that is already adequately supplied with a good quality product. An aggressive marketing campaign combined with a superior quality product will be essential.

We should be well placed to accomplish this, since we have an assured supply of crude arsenic for at least sixteen years, a process that early testwork has shown to produce a very high quality product and, the benefit of very profitable gold recovery from the process.

Producing 10,000 stpy for 16 years would deplete the reserves stored underground but does not account for the arsenic that will be produced between now and shutdown of the mining operation. This will likely take place before the arsenic storage chambers are depleted and it will therefore be necessary to design and build a plant that will or can be self-sustaining. It will also be necessary to ensure that the arsenic storage vaults are kept dry as long as necessary.

During investigations into a suitable design for a fuming reactor for pilot plant studies, a pilot roasting facility in New Brunswick was discovered. A quick cost comparison combined with a number of other considerations, seems to make the idea of having the work done in this commercial operation quite attractive.

Discussion

Given the wide range of quality of material stored underground, we would probably want to conduct about 5 separate test runs to determine overall recoveries, product qualities and gold extractions from each source. For good representation, reclaiming a total of about 80 tons of material from stopes B2-34, ~~B2-12~~, B2-08 and C12 and 20 tons from current production is recommended. *B2-34*

The 6" roaster at Research and Productivity Council's plant is capable of treating about 40 kg/hr and they prefer continuous runs of about 100 hours. 100 tons of test sample should be adequate to prove the feasibility of the fuming concept and to identify the operational limits of the process with the variety of feed that we are likely to encounter.

For reasons already given, we must be certain that we can build and operate a full scale plant that will produce a superior quality product from quite a crude feedstock. If we can achieve this, a likely production scenario is as follows.

Years 1 to 4, construct the plant and treat about 30% of the dust. This is presently stored in the B2 area and represents more than 60% of the gold contained in the dust.

| stope | tons dust | As% | Au oz/t | tons As2O3 | oz Au. |
|----------|-----------|-------|---------|------------|--------|
| B2-30 | 3125 | 45.32 | 0.766 | 1870 | 2394 |
| B3-33 | 12595 | 36.93 | 1.325 | 6142 | 16688 |
| B2-34 | 13281 | 36.10 | 2.380 | 6331 | 31609 |
| B2-35/36 | 35156 | 52.91 | 0.790 | 24559 | 27773 |
| Total | 64157 | 45.92 | 1.223 | 38902 | 78464 |

Assuming an As2O3 recovery of 95% and a gold recovery of 85%, then

As2O3 38902 X .95 = 36957 tons @ \$1000 = \$36.9 m
 Au 78464 X .85 = 66694 oz @ \$550 = \$36.7 m

Total revenue \$73.6 m

Capital cost \$5,000,000

Operating cost

upgrading 13,750,000
 freight \$12,920,000
 CN extraction \$785,000
 Total \$27,455,000

Total cost \$32,455,000

Net profit before tax, 1st 4 years \$41,145,000

The remaining 70% of stored dust (to Apr 30, '85) has the following characteristics.

| tons dust | As% | Au oz/t | tons As2O3 | oz Au |
|-----------|-------|---------|------------|-------|
| 142889 | 64.75 | 0.3335 | 122183 | 47659 |

If treated and marketed for 12 years under the same conditions

As2O3 122183 X .95 = 116074 tons @ \$1000 = \$116.1 m
 Au 47659 X .85 = 40510 oz @ \$550 = \$ 22.3 m

Total revenue \$138.4 m

Operating cost

upgrading \$30,624,000
 freight \$39,500,000
 CN ext \$800,000
 Total \$70,924,000

Net profit before tax next 12 years \$67,476,000

Pilot Plant Cost

The RPC pilot plant roasting facility in New Brunswick has two small reactors available for testing, a 6" unit and a 14" unit. The smaller reactor is able to handle about 40 kg/hr. They like to operate around the clock 100 hour test runs and they have personnel on site to do this. They operate with 2 men/shift, 3 shifts/day for a week at a time.

For plant design studies, they recommend quite sophisticated, highly controlled testing, ie. scientist on duty during the test. They estimate a cost of \$2000 - \$2500/day throughout, not including analytical testing which might, depending on requirements, be an additional \$300/day. They claim to have the best analytical lab in Canada.

It looks like a three month test could cost as much as \$250,000 not counting the cost of recovering and shipping the 100 tons of dust for the test. It is estimated that this would cost an additional \$90,000 for a total cost of \$340,000. This compares with the pilot test proposed by S.Fekete as follows

| | | |
|-----------------------|----------------|------------------|
| 25 weeks of operation | 5 day week | |
| 6 operators | 3 @ \$17.76/hr | |
| | 3 @ \$16.10/hr | |
| | X 1.35 NWLC | \$5485/wk |
| 2 technicians | | \$1828/wk |
| 1 professional | | \$2250/wk |
| consulting | | \$2250/wk |
| travel and misc | | <u>\$1200/wk</u> |
| total labour | | \$13013/wk |
| X 25 weeks | | \$325,325 |

about twice the 1980 estimate

Using the same multiplier, equipment and construction cost will be \$150,000, contingency will be \$66,000.

Total pilot plant cost \$541,325, about \$200,000 more than custom testing.

One other point to consider, Fekete's estimate included FML and Falconbrige head office assistance, which is no longer available.

Conclusions and Recommendations

Use of a custom pilot roasting facility seems to make a lot of sense in that we will not have to worry about employment and training of operators on a temporary basis, nor will we have to rely on consultants to advise on design and operating parameters. On the other hand, when we are ready to go into operation with the full scale plant, we will have to train operators from scratch.

The cost savings will be substantial though we will not have a pilot scale roasting plant at the conclusion of the test, something that would undoubtedly come in handy from time to time. We will however, have established a relationship with a custom roasting facility that may help to offset this disadvantage.

Timing of the testwork to permit construction of the full size plant next summer would give the advantage to commercial testing, since it is highly unlikely that detailed design studies and construction of a sophisticated pilot plant could be accomplished in a short time, especially since we do not have the benefit of Falconbridge's support services.

On the whole, the RPC option seems to be best and it is recommended that negotiations and detailed planning for testwork be undertaken at once so that testing can begin in November, 1987. Upon completion of the test early in 1988, plant design and construction can begin, for completion by late summer, 1988

In the meantime, market studies should be undertaken to determine how best to market up to 10,000 stpy of extra high quality arsenic trioxide. In addition, efforts should begin immediately to recover 80 tons of product from 4 underground storage chambers. A truckload of current production baghouse dust can be despatched to N.B. as soon as they are ready to begin testing.

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|----|--------|--------------|----------------|------------|---|------------|-----------|-----------------|-----------|------------|-----------------------|------------------|------|--------------------|
| 5 | Date | Capital Cost | Operating Cost | Revenue | | Cash flow | Depletion | Taxable Revenue | Tax | Net of tax | Cash flow (after tax) | NPV | ROR% | IRR |
| 6 | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | |
| 8 | | input | input | input | | (E)-(C+D) | C11%,06 | 6-H | 1x.43 | I-J | G-J | ENPV (X,L11,L26) | | EURP (1.5,L11,L26) |
| 9 | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |
| 11 | Jan 89 | 5,000,000 | 5,863,750 | 18,400,000 | | 6,536,250 | 312,500 | 6,223,750 | 2,676,213 | 3,547,539 | 3,850,038 | 27,028,672 (15%) | | 62.96 |
| 12 | Jan 90 | | 5,863,750 | 18,400,000 | | 11,536,250 | 312,500 | 11,223,750 | 4,826,213 | 6,397,538 | 6,710,038 | | | |
| 13 | Jan 91 | | 5,863,750 | 18,400,000 | | 11,536,250 | 312,500 | 11,223,750 | 4,826,213 | 6,397,538 | 6,710,038 | 22,144,7E2 (20%) | | |
| 14 | Jan 92 | | 5,863,750 | 18,400,000 | | 11,536,250 | 312,500 | 11,223,750 | 4,826,213 | 6,397,538 | 6,710,038 | | | |
| 15 | Jan 93 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | 18,661,844 (25%) | | |
| 16 | Jan 94 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 17 | Jan 95 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 18 | Jan 96 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 19 | Jan 97 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 20 | Jan 98 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 21 | Jan 99 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 22 | Jan 00 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 23 | Jan 01 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 24 | Jan 02 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 25 | Jan 03 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |
| 26 | Jan 04 | | 5,910,333 | 11,533,333 | | 5,623,000 | 312,500 | 5,310,500 | 2,283,515 | 3,026,985 | 3,339,485 | | | |

5,000,000 98,378,996 211,999,996 108,621,000 5,000,000 103,621,000 44,557,030 59,063,970 64,063,970


Kent Morton