



Giant Yellowknife Mines Limited

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7 Labatt Ave.
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For the attention of Isabella Wai, Staff Writer

Dear Ms. Wai;

Re: Your Fax of February 16, 1990

ARSENIC TRIOXIDE

As a major producer of arsenical oxides for many years, Giant has always been aware of the environmental sensitivity of the product. In recent years the company has responded to the increasing worldwide emphasis on environmental responsibility, with the result that the Yellowknife Division has developed what is considered to be the safest storage techniques commercially available. Although environmental control is already a large part of the cost of doing business throughout the mining industry, it is certain to be even more so in the future, and Giant intends to remain competitive and environmentally responsible, largely by applying the most effective of the new developments in environmental control technology.

In response to your specific questions concerning arsenic:

1. So far the Federal Government has no set limits on arsenic emissions from roasting operations. They have indicated their intention to set a limit of 20 mg of arsenic per standard cubic metre of gas exhausted from the stack. Giant stack test results indicate that this guideline is normally achieved.
2. Arsenic concentrations in tailings effluents are limited by licence to 0.8 ppm by the NWT Water Board. Giant's average effluent concentration is 0.6 ppm.
3. As far as Giant is aware, solid arsenic waste disposal outside of designated containment areas such as tailing ponds or underground storage chambers is not permitted.

4. Giant's treatment processes are capable of achieving any reasonable arsenic discharge regulation that the Federal Government is likely to legislate.
5. We do not believe that the Federal Government will place a ban on the fluosolids roasting process because of arsenic emissions. Some refractory ores do not respond well to other processes, and with some concentrates, other processes can produce an unstable ferric arsenate residue that continues to release soluble arsenic in the tailings pond.
6. Pressure leaching and biooxidation have both been tested on Giant concentrates, and it is possible that both processes could be made to work. Since Giant is a high cost producer however, it is unlikely that the company would consider switching because of the very high capital costs associated with both processes. Since there are no biooxidation plants yet operating at full scale, information regarding cost effectiveness is not available, but it seems that at low tonnages, bioleaching plants can be competitive with roasting but at higher tonnages, capital costs of bioleaching plants are prohibitive. Pressure leaching plants feature high capital and operating costs at any scale.
7. Giant has been capturing crude arsenic trioxide in a baghouse for approximately forty years.
8. The baghouse dust is then stored in underground vaults located in permafrost zones in the upper levels of the mine.
9. There is a sizeable North American market for medium purity (>98%) arsenic trioxide, and Giant is well placed to enter the market when the price is right. The purification process designed by Giant to achieve the required purity will also recover residual gold from the crude dust.
10. Giant produces approximately 3,000 tonnes of arsenic trioxide annually.
11. Arsenic emissions are controlled by first passing roaster exhaust gas through an electrostatic precipitator to remove particulate matter from the gas stream. Arsenic trioxide is then precipitated out of the gas by condensing with cold air. The solid arsenic trioxide is then captured in a cold baghouse, the clean air passing through the bags to be discharged up the stack. Annual stack sampling to check baghouse collection efficiency is conducted under government scrutiny, and the results reported to EPS and DIAND. In addition, EPS conducts dustfall and snow surveys in the area, to determine ground impingement concentration of arsenic.
12. The cost of arsenic emission control at Giant is approximately \$600,000/yr. The cost of treating arsenic-bearing waste water is approximately \$400,000/yr.
13. Arsenic-bearing waste waters are treated with ferric sulphate to produce a stable ferric arsenate sludge. Giant's tailings are not acid-generating and the arsenic will not re-activate.

For your information, Giant markets its roasting technology and has therefore prepared short descriptive articles on both the roasting process and the arsenic trioxide purification process. The articles have been attached for your review, but they are not for publication. As you may note, Giant does not consider arsenic production to be necessarily detrimental to the environment, and under the right circumstances, can be very beneficial.

Fluosolids Roasting

Treatment of refractory gold ores has confounded metallurgists for decades and today the mineral industry has still only made small progress towards finding an effective means of liberating gold when it is locked up in sulphide or carbonate ores. In fact there are only a very few processes that have wide acceptance, no one of which is suitable for all refractory ore types. Of these processes, which include fine grinding, pressure leaching and roasting, the latter two are more likely to be successful in achieving acceptable gold recoveries. Roasting is generally considered to be lower in capital and operating cost, and simpler to operate.

Giant's two-stage fluosolids roasting process has been in operation for over 30 years now, and except for refinements related to gas handling, it is still the standard against which other roasting plants are measured. During the period that Giant's roaster has been in operation, the company has established a reputation for expertise in roasting technology and is now often consulted by engineering firms and mining companies for assistance in design and operation of roasting plants.

Giant's roasting process is completely autogenous, using only sulphur in the feed as fuel to sustain the reactions. Controlled temperature and oxygen conditions in each stage results in the volatile elements, chiefly arsenic and sulphur, being carried off in the gas stream, leaving behind a porous calcine particle from which gold can be extracted by cyanidation. The arsenic oxide is collected in a baghouse filter and many plants operating roasters are able to market this byproduct. Sulphur dioxide can be scrubbed from the gas stream using lime scrubbers or, if a local market exists, the sulphur dioxide can be readily converted and recovered as sulphuric acid. Solid residues and liquid effluents from roasting processes are similar to those from conventional cyanidation plants, and waste streams can be treated effectively using common waste treatment technology.

In summary, the well-proven fluosolids roasting process continues to play a major role in the treatment of refractory gold ores around the world, and Giant Yellowknife Mines Limited is acknowledged as a leader in the advancement of roasting technology. The company provides consulting services and roaster startup assistance to the gold mining industry and is pleased to answer any enquiries.

The WAROX Process

Toxic arsenical byproducts are a fact of life for many mines and smelters throughout the world, and for these companies, toxic waste disposal is a large part of the cost of doing

business. Add to this the public concern about proliferation of toxic waste storage sites, and there are strong economic and environmental incentives for smelter operators to find better ways of dealing with these materials.

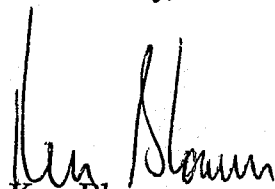
Fortunately, arsenic trioxide, the most common arsenical component of smelter byproducts, has a variety of uses, the most important as a major constituent of waterborne arsenical wood preservatives. In tests of widely used chemical wood preservatives, EPA studies gave only wood treated with arsenicals a clean bill of health. When one considers that treated wood has a useful life up to ten times that of untreated wood, there are obviously sound reasons for the consumer, as well as the smelter operator to make better use of arsenicals.

Also, there is a growing public concern about the depletion of forests caused by the demand for wood products, and reforestation programs have some way to go before they will be able to keep pace with the demand. Use of wood preservatives maximizes the useful life of wood structures, reducing the need for replacement and slowing the rate of depletion of forest reserves. Another good argument in favour of greater use of environmentally friendly arsenical wood preservatives.

Giant Yellowknife Mines Limited has developed a process that will economically convert crude arsenical smelter wastes to a highly refined, dust-free arsenic trioxide product that can be used directly by the wood preservative manufacturing industry. Depending upon the impurities originally contained in the crude material, it may be found that other valuable constituents, such as gold or antimony oxide, can also be profitably recovered from the process residues. The highly refined, dense, granular arsenic trioxide produced by this process has been registered by Giant as WAROX, an acronym for White Arsenic OXide.

Giant's process is environmentally clean, collecting 100% of the WAROX produced. The WAROX process converts crude arsenic to a high purity fine white powder that is subsequently compacted to produce dense, dust-free granules. The high bulk density of WAROX product reduces packaging, shipping and storage costs, and the dust-free feature is particularly appreciated by customers who have to store and handle the material.

Yours truly,



Ken Blower

Vice President Operations