THE ARSENIC PROBLEM AT YELLOWKNIFE, N.W.T.

The ore from the mines at Yellowknife is not entirely free milling, and does not lend itself to the most economic treatment of gold recovery until the sulphides containing arsenic are removed. This beneficiation requires that the ore be roasted to remove the sulphide content, as well as the arsenic and other impurities, before being treated by cyanidation in the mill where the gold is recovered from the ore.

At the present time there are two mines treating their ore by the roasting process prior to treatment in the mill, namely, Consolidated Mining and Smelting Company's Con Mine and Giant Yellowknife Gold Mines. The Negus Mine is stock-piling a roaster concentrate, but, as yet, have not installed a roaster to recover the remaining gold in the tailings concentrates. Although Akaitcho anticipate the same problem in the beneficiation of their ore, they have not made any plans as yet for establishing roaster units if they erect a mill as soon as they start recovering any ore.

The Con Mine used their roaster since the commencement of operations, and they have been operating continuously since 1946. It was not until May, 1949, that the problem of arsenic trioxide being precipitated from the roaster smoke and distributed in the surrounding area, gave rise to an acute situation. The Giant roaster, which commenced operations in January, 1949, together with the Con roaster, was responsible for a heavy precipitation of arsenic being distributed in the vicinity of Yellowknife. Due to the semi-arid climate in the Yellowknife area, and the long winter, there is a short period every spring when the run-off water in certain localities carries a dangerous accumulation of arsenic. Mr. Bevin, who operated a dairy farm at Kam Lake, about one mile from the Con roaster, dammed up a small creek, whereby the run-off water was impounded, and he planned on using this water for his cattle. This, he did, and because of the high arsenic content in the run-off water, the cows became poisoned

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and died in May of 1949. The Consolidated Mining and Smelting Company immediately took steps to eliminate the danger of arsenic trioxide being precipitated from their roaster smoke. They called in their Industrial Hygiene Consultant, who immediately began research to find out how the arsenic trioxide could most economically be eliminated from the smoke.

Mr. Copp, of the Department of National Health and Welfare, was asked for a report on the situation, and at that time, he suggested that further investigation would have to be carried out on the subject. The writer, of the Department of Resources and Development, made extensive investigations, and wrote numerous reports on the subject in 1949. In the meantime, both Mr. A.K. Muir, General Manager of Giant Yellowknife Gold Mines, and Mr. W.G. Jewitt of Consolidated Mining and Smelting Company, discussed the problem fully with Dr. Stanton, the Local Medical Health Officer at Yellowknife, when it was decided that precautions must be taken to protect the residents of Yellowknife from inadvertent poisoning by arsenic trioxide.

During the summer of 1949 several samples of water and vegetables were analyzed, and traces of arsenic were found in these samples taken in and around the settlement of Yellowknife.

Investigations were made at various mines confronted with a similar problem, and it became apparent that the main problem would resolve itself into the disposition of the arsenic trioxide once it had been removed from the roaster smoke.

The Consolidated Mining and Smelting Company, through investigations made by their experts, developed a method for extracting the arsenic from the smoke. This became known as the "Impinger" type of arsenic removal, and they found that in the early stages of experimenting with this new process, they were able to recover approximately 90 per cent of the arsenic trioxide, and have, since, through improvements on the original setup, improved the extraction process to approximately 98 per cent recovery.

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It was found that the Province of Quebec had legislation to cover the problem, and mines facing a similar problem in the Province of Quebec were compelled to remove the arsenic trioxide from the roaster smoke. In Ontario no regulations were imposed, and it was the direct responsibility of the mining company concerned, whether or not they should install equipment to extract the arsenic trioxide. Legislation in Manitoba, Saskatchewan and British Columbia provided protected areas.

Discussions were held with Dr. Charron and Mr. Menzies of the Department of National Health and Welfare on the 24th of September, 1949, after the writer had submitted a full report on the problem at that time. Following this, Dr. Charron suggested that officers of both Departments make an investigation at Yellowknife - and Dr. Kay, Chief, Industrial Health Laboratory, Department of National Health and Welfare; Mr. R. Traill, Chief, Mineral Dressing and Metallurgy Division, Department of Mines and Technical Surveys and the writer, held a conference on the 22nd of November, 1949, when it was decided that they should make an investigation at Yellowknife as soon as possible, this they did during the latter part of the month of November, 1949. As a result of this investigation, a letter dated the 14th of December, 1949, from Dr. Cameron, Deputy Minister of National Health to Mr. R.A. Gibson, recommended that roaster operations be stopped forthwith, and that they remain so until proper arsenic collection and disposal practices entirely eliminating the health hazard be placed in operation.

A special meeting of the Northwest Territories Council was held on the 22nd of December, 1949, and after hearing the report of the investigators, the Council agreed that enough investigations had been done in connection with this problem to show that a dangerous hazard had been certified. The reports presented to Council indicated that this hazard would have to be dealt with by the mining companies, improving their methods of handling the arsenic content of this ore, and to ensure that residents of the Yellowknife district be protected

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from the effects of any arsenic produced from mining operations. The Northwest Territories Council decided that it was necessary that the mining companies install efficient and satisfactory methods for collection and disposal of the arsenic. Letters to this effect were despatched to both Mr. Jewitt and Mr. Muir, with separate letters concerning the situation sent to Dr. O.L. Stanton, Medical Health Officer and Mr. A.H. Gibson, Mining Recorder, at Yellowknife.

On the 18th of January, 1950, Mr. Muir, General Manager for Giant Yellowknife Gold Mines and his metallurgist, Dr. Hubler; Dr. Charron and Dr. Kay, representing the Department of National Health and Welfare; Dr. Atkinson, representing the Department of Agriculture, Dr. Katz, of the Defence Research Board; Mr. C.S. Parsons and Mr. Traill of the Bureau of Mines; Mr. C.K. LeCapelain, Mr. K.J. Christie and Mr. R.A. Gibson, held a meeting in Mr. Gibson's office to discuss the arsenic problem.

Mr. Muir announced that he was prepared to recommend to the officers of his company the immediate purchases of Cottrell equipment to remove the arsenic from the roaster smoke. Mr. Gibson asked Dr. Charron, whether, under the circumstances, the Deputy Minister of Health would be willing to modify his recommendation that the roasting operation at the Giant Mine should be closed down, because, as Mr. Muir explained, this would mean the closing down of the mines, which, in turn, would result in economic disaster at Yellowknife. After consulting with his Deputy Minister, Dr. Charron reported the following day that the recommendation previously made would have to stand. However, if, despite this recommendation, Council would be prepared to take the calculated risk, then the Department of National Health and Welfare would be prepared, on request, to assist in reducing this risk to a minimum.

On the 20th of January, 1950, Mr. Muir advised that his company had placed a requisition for the necessary Cottrell equipment through the Precipitation Company of Canada Limited, and asked whether a letter from Mr. Gibson could be forwarded to this company emphasizing the importance of maintaining the promised deliveries. A letter was sent to

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this company on the 23rd of January, 1950, and acknowledged the 1st of February, assuring that they would make every effort to deliver the equipment at Waterways, Alberta, on or before the 1st of August, 1950, for transportation to the mine.

On the 8th of February, 1950, a meeting was held in Mr. R.A. Gibson's office, with the following gentlemen in attendance: Mr. W.G. Jewitt; Mr. K. Raht; Dr. K.K. Kay; Dr. K.C. Charron; Dr. O.L. Stanton; Dr. B.J. Atkinson; Dr. M. Katz; Mr. C.S. Parsons; Mr. R.J. Traill; Mr. K.J. Christie; Mr. G.M. Webster and Mr. C.K. LeCapelain.

Mr. Jewitt was asked to outline the problem and open discussion on the subject. Mr. Jewitt described the "Impinger" method of extraction and Mr. Raht outlined their plan for disposing of the slurry resulting from the extraction. Pits were dug into the old tailings pile to receive the slurry, and it was suggested that a seepage ditch, made impervious to percolation would be dug if required, so that the liquid from the slurry pits could be returned to the "Impingers" for re-circulation.

Dr. Stanton did not feel there was any immediate danger of arsenic poisoning to the community except by drinking snow water, but he could foresee a definite hazard during the spring run-off period and the berry picking season, and he had warned residents of this danger by inserting notices in the local paper and by letter to the mining companies concerned. He also presented clinical data. Mr. Raht elaborated on the "Impinger" method of extraction, and Mr. Jewitt gave his assurance of cooperation in performing a continuing survey, and Mr. Gibson asked Mr. Jewitt to submit his proposals for disposal of the arsenic trioxide with engineering plans.

A meeting was held in Dr. Charron's office the following day, the 9th of February, 1950, with Dr. Kay, Dr. O.L. Stanton, Mr. K. Raht and the writer present. After some discussion, it was decided that a continuing survey would be made whereby a close check could be kept on contamination of the surrounding area. Dr. Charron wrote to Mr. Gibson on the 11th of February, 1950, outlining this survey that was

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to be followed. On the 25th of February, 1950, Mr. Jewitt gave his assurance that their Company were in agreement with the proposed continuing survey, and offered every assistance in eliminating any danger to the health of the Yellowknife community, so far as their operations were concerned. Mr. Muir also assured Mr. Gibson by letter of the 14th of March, 1950, that the measures as recommended by Dr. Charron would be followed (see attached copy of Dr. Charron's letter.)

During the spring of 1950, Dr. O.L. Stanton, the Local Medical Health Officer, posted notices in the Yellowknife papers and warned the residents of Yellowknife that there would be a danger during the run-off period and at breakup, in drinking water from stagnant pools and melting snow. Despite the warnings given, two horses died as a result from drinking stagnant water on Latham Island during the latter part of May, 1950. The residents at the Giant Mine were supplied with drinking water from the town water supply.

The problem of disposal of the arsenic trioxide was thoroughly investigated by Dr. Kay in June, 1950, as well as a study made on an area for disposal by the writer. In the meantime, the Con Mine were not satisfied with the disposal of slurry in the old tailings pile, and investigations were made with an area located where the arsenic trioxide in the wet state could be impounded for several years by erection of a dam across a natural amphitheatre. This method of disposal at the Con Mine was instituted during the fall of 1950, and has worked successfully to the present. There is sufficient storage space for several years in this basin. The Con Mine have been operating their "Impingers" 96 per cent of the time with an extraction efficiency of 98 per cent (plus).

It was expected that the Giant Mine would have their equipment for extraction of the arsenic by the fall of 1950, however, due to the Winnipeg floods in the spring of that year, as well as the railroad strike later in the season, the Cottrell equipment was not delivered by freeze up in the fall of 1950. The Giant Mine had trouble in analyzing water and plant samples due to contamination within the

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laboratory which is adjacent to the roaster, therefore, they asked the Department of National Health and Welfare if it would be possible to have their samples analyzed in Ottawa. During the winter of 1950-51 the Giant Mine did not take samples of the snow, however, the Con Mine made an extensive survey and reported results of analyses monthly.

From the results of analyses of snow samples, as well as observations made by the writer on his inspection trip during February, 1951, a wire was sent to the Local Medical Health Officer on the 14th of April, 1951:

"Re arsenic situation at Yellowknife and letter by K. Raht dated 7th March indications of continuing arsenic survey show heavy concentration of arsenic in snow especially at north end Latham Island STOP Consider it advisable to warn residents in and around Yellowknife that certain precautions should be taken during period when snow is melting and at breakup season STOP Suggest same procedure be followed as in spring of 1950"

with a reply, dated the 16th of April:

"Precautions being taken warnings printed last two issues local papers signs posted around town."

Then, on the 17th of May, a code message was received from S. Homulos:

"Child age two died of arsenic poisoning from lake water north end Latham Island STOP Letter has been forwarded STOP Further investigation."

Regarding the Cottrell equipment at Giant, we have been advised that the balance of the equipment has been delivered across the ice of Great Slave Lake, and the Cottrells for removal of the arsenic trioxide at the Giant roaster will be installed as soon as possible. It is the intention of Giant Yellowknife Gold Mines to store the arsenic trioxide, which is in a dry state, in underground chambers within a permafrost zone on their property. Mr. Muir outlined their proposal for this method of storage, and it would appear that by keeping the arsenic

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trioxide in a naturally frozen state there would be no danger from circulating waters, as experienced in mines in the Province of Quebec.

K J Christie

Ottawa, Ontario,
26 May, 1951.

K.J. Christie,
Chief Mining Inspector.