File – arsenic disposal

Department of Indian Affairs and Northern Development
Resource and Economic Development Group
Ministère des Affaires indiennes et du Nord canadien
Bureau des ressources et du développement économique

W.A. Case, Esq.,
Mine Manager,
Giant Yellowknife Mines Ltd.,
Yellowknife, N.W.T.

Ottawa 4, May 11, 1967
our file/notre dossier
your file/votre dossier
date 990-3-5

Dear Mr. Case,

I refer to your letter of April 6, 1967, requesting approval to use the C2-12 area for underground storage of arsenic. Since Public Health Engineering Division of the Department of National Health and Welfare have some jurisdiction in this area we will seek their advice and concurrence with any approval given. A meeting is being arranged this week with officers of Public Health Engineering to discuss the problem. When approval was first granted for storage of arsenic in underground chambers at Giant in 1951 the Department of National Health and Welfare were in on the discussions and it was stipulated that such chambers must be completely enveloped by perma-frost. I enclose a copy of correspondence between your Company and the Department relating to this topic.

We agree with you that the perma-frost shield above the area concerned is a continuous layer and prohibits seepage of surface waters from entering the storage area thus making the ground appear competent. There is one problem however, and that is that when arsenic is brought into the chamber heat is introduced. Will there be sufficient heat introduced over a prolonged period to destroy this perma-frost shield from within the chamber. What steps will be taken to prevent this from occurring.

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Recent sampling of various points in Yellowknife Bay indicates that the Bay water is remaining at a high level of arsenic content and well above the accepted level. This means

(1) that either the Bay water is gradually reaching a point of saturation because of insufficient outflow of water from the Yellowknife River or

(2) that there are unknown sources of contamination other than from Baker Creek and effluent from the tailings pond.

The problem is reaching a point where immediate serious thought and study is required to determine what action is necessary. In regard to the above possibilities Public Health Engineering have completed a sampling program on the Bay on a $\frac{1}{4}$ mile grid to determine arsenic levels in the waters across the Bay and at various depths. Results of this sampling program are not yet available.

In order to determine if there are other sources of contamination we request that you investigate without delay your internal housekeeping procedures to ascertain the possibility of unknown sources that may be contributing to this problem. We would also request that you provide figures relating to known discharges into Yellowknife Bay in terms of volume and the content of arsenic in order that this may be related to the volume of fresh water entering and passing through the Bay.

Depending on the outcome of these studies it may be necessary to

(1) seek other sources of domestic water supply for Con, Town and Giant such as from the Yellowknife River or

(2) divert the flow of effluent from the tailings pond and other sources of arsenic contamination away from Yellowknife Bay to prevent this water from becoming unusable.

Yours sincerely,

Brian G. Town

G.H. Caldwell,
Chief,
Resource Management Division.

GIANT YELLOWKNIFE GOLD MINES LIMITED
(NO PERSONAL LIABILITY)
YELLOWKNIFE, N.W.T.
CANADA

1951

February 24th, 1951

G. E. B. Sinclair, Esq.,
Director,
Northern Administration and Lands Branch,
Department of Resources and Development,
Ottawa, Ontario.

Underground Storage of Dry Arsenic Tri-oxide
Your File: 53124

Dear Mr. Sinclair:

The question of the safe and economic disposal of the dry arsenic tri-oxide which will be collected by our new Cottrell plant has been carefully studied by officers of your Department and the Department of National Health and Welfare, and by members of this Company's staff, both at the mine and in Toronto.

As a result of an examination made by Mr. K. J. Christie, Chief Mining Inspector, followed by test excavations made by the Company, the proposal to bury the material in the sand plain west of the Yellowknife Airport was abandoned. These excavations showed the water table to be a few feet below the surface in this area.

Disposal in Veronica Lake, which lies in the granite to the northwest of the plant, was carefully studied by Dr. Kay, of the Department of National Health and Welfare, and our staff. While this method was of definite interest, it was felt by Departmental officers that much more information would have to be available before consideration could be given to this means of disposal. This opinion was given to us in Mr. R. A. Gibson's letter of July 21st, 1950. We agreed with this opinion and, as the time element would prevent the accumulation of the necessary data on physical conditions, run-off and precipitation. before the Cottrell plant came into operation, it was decided to concentrate our investigations, which were already under way, on the possibilities and economics of surface storage in tanks and on storage underground.

In his letter of July 21st, 1950, Mr. Gibson stated that, while the officers of the Departments concerned regarded the use of concrete vats on surface as the safest method of storage, they did not want to put the mining companies to unnecessary expense and therefore favoured the proposal for underground storage, provided certain requirements were fulfilled. This practical and reasonable approach encouraged us in our efforts to locate suitable areas for satisfactory underground storage.

Two of the major requirements for effective disposal locally are that the storage selected must last indefinitely and that large capacity must be obtained at an economic cost and in a relatively small area. Our studies of surface storage included wood, steel and concrete tanks. Wood

tank staves contract on drying and are difficult to support in any reasonable size. Steel tanks, while relatively easy to construct in large sizes, would corrode and we were advised by the Chemical Division of Canadian Industries Limited that they knew of no permanent lining or coating that would last indefinitely.

The use of concrete tanks was investigated in detail and our Mill Superintendent and myself made trips to Northwestern Quebec to inspect the concrete storage at Consolidated Beattie Gold Mines. While reasonably safe storage can be provided by this method, the cost of such vats erected in Yellowknife would be excessively high and tankage of the largest economic size would hold our Cottrell plant output for a surprisingly limited period. For example, a rectangular reinforced concrete vat, 60' x 100' x 24' high, with a capacity of 144,000 cu.ft., would cost $50,000.00 erected, and would have sufficient capacity for about 2½ years at our current milling rate and for a little over one year at a milling rate of 1,000 tons per day. Thus, in addition to the high cost of such structures, it would be necessary to carry out an almost continuous construction program, requiring a large surface area for suitable tank sites and substantial quantities of form lumber, reinforcing steel and cement.

As mentioned in my letter of July 8th, 1950 to Mr. Gibson, we were then giving serious consideration to underground storage. This method was also being studied at Negus Mines, and Mr. J. G. McNiven, Manager of that Company, had written your Department reporting favourably on this means of disposal. At Giant Yellowknife we re-studied drill core logs and other data on sub-surface conditions in various parts of the property, isolated from the mine workings. As a result of this study we were convinced that permanent, safe storage could be obtained in an area of relatively massive rock in the Cottrell plant area. Most importantly, this area was believed to be in the "permafrost" zone to a depth of at least the second level (250 ft.) of the mine workings and it was isolated from any underground openings.

The area was explored on the second level by driving a new drift and crosscut for a distance of 650 feet from the closest mine opening, followed by the drilling of horizontal and inclined diamond drill holes from the crosscut. Relatively good ground conditions were indicated in these holes, which were drilled in permanently frozen rock. Two surface holes were then drilled in the same area, both of which showed that the proposed excavation would be in permafrost. It was then decided to proceed with the necessary stope preparation and to make a start on mining the proposed block, in order to expose ground conditions and check on the permafrost condition.

It is our experience in all working places in the permafrost zone that active mining operations tend to thaw the surrounding walls for a very limited distance, possibly a few inches, due chiefly to the heat generated from blasting. However, within a few hours of the cessation of active work, the working places again become completely frozen. In the closest mine working (208 Stope) on this level to the proposed excavation,

all faults and fractures were found to be ice-filled. As stoping progressed, some thawing took place, but since operations were completed recently, the stope is again completely frozen.

Based on our experience to date, it is our opinion that an excavation in the permafrost zone would provide the safest possible storage in perpetuity. Within reason, it can be said that no seepage or migration of water would occur in such an area. We feel that the area already tested by drilling and active mining would fulfill these conditions. In this way the presence of permafrost, which is a considerable handicap in other phases of our operations, would be made to serve a particular and important purpose.

An important advantage of the area selected near the Cottrell plant is that direct mechanical conveying from the precipitation units can be effected; thus eliminating any handling and transportation by truck or other means which would be required should surface storage be necessary. Also, within the area which can be serviced by the type of conveyor to be installed, there is adequate space to excavate the underground chambers required for many years.

Excavation of these chambers can be carried out at less than half the cost of surface concrete vats of equal capacity and the waste rock broken will be available for mine fill. Compared to the problems involved in the construction of concrete vats, excavation of these underground chambers is relatively easy as the stoping operations would be a part of the regular mining routine.

A raise will be driven to surface where a tight concrete collar would be installed and the chamber would be properly vented to take care of possible development of arsene. Provision will be made during the winter months to blow cold surface air into the chamber as an additional means of ensuring permafrost conditions.

The attached plan shows the location of the proposed storage chambers with reference to the Cottrell plant and the closest mine workings. Each crosscut from which the chambers would be excavated would be sealed with a tight concrete bulkhead so that there would be no possible contact with the existing workings. It might be mentioned that these workings are now completely frozen and that the new drive on the second level to the proposed storage area was in permanently frozen ground for its entire length of 650 feet.

It is realised that there is no absolutely safe means of arsenic disposal. With storage in surface tanks there is always the possibility of leakage through the development of cracks, and even sabotage, which would be much less practicable in an isolated underground storage. Shipment out of the district would entail the normal risks of container breakage. We would emphasise that the arsenic tri-oxide will be produced in the dry form and that it should remain perfectly dry and stable in permanently frozen ground.

The methods studied have been discussed with Mr. E. V. Neelands, Consulting Engineer, and Messrs. C. W. Dowsett and W. G. Hubler, Consulting Metallurgists for the Company. Underground storage under the permafrost conditions described above is recommended by these consultants. A letter from Mr. Hubler is attached outlining the several methods investigated. Dr. O. L. Stanton, Medical Health Officer, has been fully advised of developments and, we understand, has written you giving his approval of the underground storage project.

Mr. K. J. Christie, Chief Inspector of Mines, has recently studied the data on which we are basing our decision to recommend this method of disposal.

You will be glad to know that shipment of the Cottrell plant steelwork is now being made from Winnipeg to Peace River. Design and fabrication of this steel was seriously delayed by the Winnipeg flood last year, as the Manitoba Bridge Company had originally promised delivery by September 1st at Waterways. Arrangements have been made for the transportation of this material to Hay River via the Mackenzie Highway and thence by truck and tractor across Great Slave Lake to Yellowknife. While the freighting cost will be at least twice that on the river route, erection of the building will be greatly expedited and it is hoped that at least two months will be gained in completion of the Cottrell plant.

We trust that this letter will give you the information required and that we have furnished satisfactory evidence that underground storage here will reasonably meet the requirements of the Departments concerned. We are enclosing copies of this letter for the Department of National Health and Welfare, and for Mr. Christie. A copy is also being forwarded to Dr. Stanton. As I shall be in Toronto for the next two weeks, I would be glad if you would get in touch with me at our office there, should any further information be required.

Yours very truly,

GIANT YELLOWKNIFE GOLD MINES LIMITED

A. K. Muir
General Manager

AKM/bp

Recall for Mr Christie

chgd to Mr. Bishop 1-3-51 and is now chgd to the Director 3-3-51

OLIVER L. STANTON, B.A., M.D.
YELLOWKNIFE
N.W.T.

Noted GEBS

February 27,1951.

CHIEF
MAR 3
LANDS DIVISION

NORTHERN ADMINISTRATION
REGISTRATION
MAR 2 1951
Dept. of Resources and Development

DEVELOPMENT SERVICES BRANCH
MAR 2 1951
CENTRAL REGISTRY
Dept. of Resources and Development

Mr. G.E.B. Sinclair,
Director Lands& Development,
Services Branch,
Dep't. Resources & Development
Ottawa, Ontario.

Dear Mr. Sinclair:

Re: Arsenic disposal Giant Yellowknife Mines

I have recently discussed the above with Mr. Muir and Mr. Pitcher of Giant Yellowknife Mines. Their proposal of storing the arsenic in underground stopes, well away from the mine workings, and completely surrounded by permafrost appears to me to be an excellent method for safe disposal. The engineering problem should be very simple and I cannot see how there could be any leakage through permafrost. To me, this underground storage is much safer than any form of storage or disposal on surface; and, unless some very definite contra-indication can be pointed out it has my complete approval.

Yours very truly,

O.L. Stanton M.D.

OLS/mb

O.L. Stanton M.D.