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SEALING ARSENIC TRIOXIDE IN DRUMS
AT THE 1,500-FOOT WEST LEVEL OF THE O'BRIEN MINE -
SULPETRO MINERALS LTD., CADILLAC, QUEBEC

 Government of Canada / Gouvernement du Canada		ACTION REQUEST		FICHE DE SERVICE	
To - A		Date <i>Sept 28 1985</i>			
<i>A. Schutty</i>		Time / Heure			
From - De		<i>M. O'Brien for Neill</i>			
Language spoken - Langue utilisée		Telephone No. - N° de téléphone		Extension Poste	
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GC 218 (89/08) 7540-21-907-5351

J.D. Charlton
Mine Geologist
March 11, 1985

A) Introduction

A total of 1,253 short tons of arsenic trioxide are stored in two galleries at the 1,500-foot west level of the O'Brien Mine. A by-product of the roasting process, they were placed there by the previous operator, the M.J. O'Brien Mining Co. Ltd., between 1940 and 1956, when the mine closed. The impermeable bulkhead constructed by the O'Brien Mine to contain the arsenic was demolished by Consolidated Goldfields in 1980.

Today, the O'Brien Mine is owned by Sulpetro Minerals Ltd. It is kept dry to below the 1,875-foot level, but is currently inactive.

The Quebec Department of the Environment must find and approve a permanent solution to the arsenic problem. The solution proposed in this report involves sealing the two galleries containing the drums of arsenic trioxide with thick concrete caps.

Two other solutions have been rejected. The first would have been to find a purchaser for the arsenic trioxide; but after an extensive search, we discovered that there is no market for this product. The second would have been to remove all the drums from the mine and transport them to Stablax Canada Inc., in Montreal. However, this approach would have been dangerous and very costly.

The solution presented here in detail was suggested by the Department of the Environment, and we (Sulpetro Minerals Ltd.) concur that it represents the most effective and safest approach. If it is approved, we can do the necessary work this summer (1985), under the supervision of a representative from the Department of the Environment.

B) Background

The O'Brien Mine was discovered in 1924 and began producing gold in 1927. Its own mill began operating in 1933. The mine was permanently closed in 1956 after having produced 1.3 million short tons of ore at an average grade of 0.467 ounces per ton. Recovery was high (an average of 96 percent) because three to four percent of the ore was arsenopyrite and, as a result, a roasting system had to be used. The matrix of the arsenopyrite crystals contained a variable percentage of ore, which was not recoverable in the roasting process. Arsenic trioxide was a by-product of roasting.

The M.J. O'Brien company sold a small percentage of the arsenic trioxide, but a market could not be found for the entire production. The surplus was put into 400-pound drums (empty cyanide drums) and eventually stored at the 1,500-foot level in a long abandoned drift west of No. 3 shaft. All the arsenic trioxide was stored there until the mine closed in 1956. Before allowing the mine to flood, O'Brien constructed an impermeable bulkhead across the entrance to the drifts.

The mine remained abandoned for several years. In 1972, Darius Gold Mines Inc. pumped it out to below the 1,500-foot level. For the next nine years, this company and the international mining company, Consolidated Goldfields, carried out exploration and development work, putting the mine into production from 1978 to 1981. In 1980, Goldfields thought that it had found a buyer for the arsenic and demolished the impermeable bulkhead. When the potential buyer decided not to purchase the arsenic, Goldfields looked all over the world but was unable to find another buyer.

In November 1981, Sulpetro Minerals Ltd. bought the O'Brien Mine. We (Sulpetro Minerals) also made several unsuccessful attempts to find a buyer for the arsenic trioxide. Stablax Canada Inc. also studied the problem, but their preliminary cost estimates for removing all the drums, transporting them to Montreal and making an insoluble cement were prohibitive.

We designed another impermeable reinforced concrete bulkhead which would have been installed in the same place as the O'Brien bulkhead, but which would have been thicker and stronger. The Department of the Environment rejected this design and recommended the two thick concrete caps which are proposed here. The drawings for the caps and a description of the rock works required are attached to this report. If it is approved, the project can be completed this summer (1985).

C) Description of the arsenic trioxide storage site

1) General: A total of 1,253 short tons of arsenic trioxide are stored in 8,928 drums (400 pounds each) at the 1,500-foot level to the west of No. 3 shaft at the O'Brien Mine. The drums are located in two drifts (15-G-West and 15-F-West) west of 15-01 XC North (see plan). The 15-G-West drift is 200 feet long, and storage drums occupy 140 feet of this length. The 15-F-West drift is 1,740 feet long, with drums along most of its length. After 29 years under water, a large percentage of the drums are rotten.

At the present time, almost no water is escaping from the galleries. In other words, the galleries do not intersect any underground water channels. No opening, other than borehole 229, intersects the galleries. As shown on the plan, this is a horizontal hole which starts at the station beside the shaft. It will be plugged with an expanding cap and concrete.

2) Geology: To date, all ore-bearing veins are hosted by the Piché Group.

The Piché Group is a sedimentary-volcanic sequence, deposited above the Pontiac Group which lies to the south of the Piché. The Piché is bounded on the north by the schists of the Cadillac Break. The Piché Group strikes east-west and dips from 80 to 90 degrees south. In the western part of the O'Brien property, the sequence has a north-south thickness of 350-400 feet. From south to northeast, the sequence consists of mafic volcanic rocks (basalts), a tuffaceous quartz-feldspar porphyry, a conglomerate, another tuffaceous quartz-feldspar porphyry (richer in quartz), and finally a member which is a mixture of greywacke, tuff and graphitic argillite in contact with the Cadillac Break. The Piché Group has been subjected to a high degree of north-south compression.

The two drifts of interest here are located in the two northernmost members of the Piché Group. The 15-G-West drift is in the graphitic argillites and the graphitic schists of the mixed member. The talc and chlorite schists of the Cadillac Break are approximately twenty feet north of 15-G-West. The 15-F-West drift is a very long exploration drift, part of which is located in the quartz-feldspar porphyry (north) and part of which follows the north contact (with the mixed member). Both drifts follow the structure, which is basically parallel to the schistosity of the rock. The porphyry is very competent and hard.

There are very few inclined faults or joints in the two drifts and, along the faults which do exist, there has only been a few inches of displacement. Fracture planes are closed. In short, the rocks around both drifts are hard and competent and were not disturbed by mining operations. It is very difficult to imagine how a solution could travel very far in undisturbed structural conditions such as those which exist at the 1,500-foot west level.

D) The concrete caps (see plan)

Two concrete caps are proposed: one for the 15-G-West drift, and one for the 15-F-West drift. Both caps are in narrow sections and are 16.5 feet west of 15-01 XC North (the crosscut). The first arsenic drums are about forty feet to the west.

As stated earlier, some rock work will be required at each location before the concrete can be poured. This will consist first of cleaning both locations—particularly the floors—and then making two-foot-deep slashes in the walls, roofs and floors. Concrete cap 1 will not require a slash on the south wall because there is already one there. It is the shape of the cap that is most important to its strength.

The two caps will be seven to eight feet thick. Their maximum width and height will be the same as those of the drifts, plus two feet on each side, as shown. Their minimum dimensions will be the same as their respective drifts. Plywood forms supported by roundwood will be constructed to contain the concrete. The concrete will be poured through pipes from No. 3 shaft station to the wood forms, and the forms will be filled with concrete up to the top of the roof. In this way, no water will escape through the caps. The strength of the concrete to be used will be 3,000 pounds per square inch (the water pressure at the 1,500-foot level will only be 750 pounds per square inch), and it will be mixed with 3/4-inch aggregate.

A corrosion-resistant metal plate to be placed on each cap will bear an engraved warning stating the nature of the hazard and the date of construction of both concrete caps.

As mentioned earlier, where borehole 229 leaves the 15-F-West station and enters the drift, it will be plugged with an expanding cap and concrete. It will also be plugged with concrete in the 15-14 drift (see plan). This is the only borehole that intersects the arsenic trioxide storage drifts.

E) Conclusions

The proposal to construct two concrete caps to seal the arsenic trioxide at the 1,500-foot west level of the O'Brien Mine does not represent a perfect solution to the problem. But the two drifts in question are dry, solid, competent and isolated. Strong, impermeable caps will be constructed to eliminate the possibility of water leakage.

The alternative—taking out the 8,928 rotten drums and transporting them to Stablex—would be too dangerous and too expensive. Under these circumstances, the most effective and safest solution is to seal the arsenic trioxide and isolate it from the outside environment. The proposal described here would permanently eliminate the problem.

Signed this March 13, 1985

[original signed by]
Jack Charlton,
Mine Geologist

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E.S. Short,
Mining engineering consultant

at Cadillac, Quebec.

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[Page 7: Key to numbered translations]

- 1) western extension of the 15-F-West Drift
- 2) *EXTENSION OF THE As_2O_3 STORAGE DRIFT*
- 3) continued above
- 4) *ARSENIC TRIOXIDE STORAGE DRIFT*
- 5) *CONCRETE CAP 1*
- 6) 15-G-West Drift
- 7) 15-F-West Drift
- 8) *CONCRETE CAP 2*
- 9) 15-14 Drift
- 10) No. 3 SHAFT
- 11) To No. 2 Shaft
- 12)

<i>SULPETRO MINERALS LIMITED</i>		
<i>March 7, 1985</i>		
Location of proposed concrete caps and As_2O_3 storage drums at the 1,500-foot level of the O'Brien Mine		
Scale: 1"= 100'	Cadillac Township NTS 32/D/1	Drawing: J.D. Charlton Approved: E.S. Short

**CHARACTERIZATION AND MONITORING GROUP FOR
HAZARDOUS WASTE DISPOSAL AND STORAGE SITES**

BY: ANDRE PAQUET, ENGINEER, M.Sc.

**QUEBEC DEPARTMENT OF THE ENVIRONMENT
HAZARDOUS SUBSTANCES DIRECTORATE**

**CHARACTERIZATION REPORT
SITE 08-28B
"O'BRIEN-DARIUS ARSENIC TRIOXIDE REPOSITORY"**

OCTOBER 1989