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Nunavut Water
Board

SEP 26 2003

Public Registry

PROJECT MEMORANDUM

To:	Indian and Northern Affairs Canada	Fax No.:	(867) 975-4286
Attention:	Carl McLean, Manager Land Administration Operations	CC:	P. DiPizzo (867) 360-6369
From:	Holger Hartmaier (Ext. 113)	Date:	September 26, 2003
Subject:	Polaris Mine- Review of Portal Seal Design		
No. of Pages (including this page):	3 Pages	Project No:	0131-013-01

As requested, under the Standing Offer Agreement 01-03-6011, I have reviewed the drawings and specifications prepared by Teck Cominco showing the proposed design for sealing the mine portals at Polaris.

Specifically, the following drawings, prepared by Gartner Lee Ltd. (GLL) were submitted for review:

- Drawing Number 23307-0, Portal Plug Design- Polaris Mine, Nunavut, Specifications.
- Drawing Number 23307-1, Portal Plug Design- Polaris Mine, Nunavut, Sections (Revision 1, dated August 6, 2003).

As noted in Teck Cominco's letter, dated August 29, 2003, the design was also submitted to the Worker's Compensation Board for their review and approval.

General Comments

There are four mine portals that need to be sealed:

- North Portal
- 1972 Exploration Portal
- Main Portal
- Conveyor Portal

The reclamation plan (GLL, 2001) called for construction of steel and concrete bulkheads. Subsequently, Teck Cominco has revised the seal design to use cemented rockfill bulkheads instead. The April 15, 2002 joint approval letter issued by NWB/DIAND, required that the final

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BGC Project Memorandum

To: Carl McLean

From: Holger Hartmaier

Date: September 26, 2003

Subject: Polaris Mine- Review of Tunnel Portal Design Drawings and Specifications

Proj. No: 0131-013-01

design of the seals be submitted to the Mines Inspector for approval prior to construction. We are aware that Teck Cominco has met with Mr. Martin Van Rooy, P.Eng., Inspector of Mines/Engineer Prevention Services for Workers Compensation for Nunavut and NWT to review these drawings, in accordance with this requirement.

Technical Issues

The design, as currently proposed in the drawings and specifications is an improvement over the steel/concrete bulkhead concept originally proposed in the reclamation plan (GLL, 2001):

- The design utilizes the cemented rockfill (CRF) concept, which is a proven technology, having been used as backfill for the underground stopes during active mining operations. BGC understands that there are sufficient quantities of left-over cement from the CRF plant remaining on site to satisfy the requirements of the mine seals. Utilizing this material will get rid of the remaining cement on-site.
- The design ensures complete backfilling of the portal and support of the rockmass around the tunnel from the ground surface to a distance underground that should prevent caving and subsidence of the overlying cover materials.
- The materials to construct the plugs are available in large quantities at the site.
- There is no need to assess the structural integrity of the plug as all materials are placed at the angle of repose and will be confined within the tunnel openings and will not be retaining a head of water.

There two major technical issues with respect to the proposed design that should be addressed:

The first issue is with respect to the plug location in the North Portal. From a strict tunnel stability perspective, as a general rule of thumb, the minimum thickness of rock cover over a tunnel at a portal should be at least one tunnel diameter and preferably two. This requirement is based on the fact that the rockmass close to the ground surface is usually weathered and loosened, compared to the rockmass around the rest of the tunnel at depth.

As shown on the drawing, the minimum cover over the tunnel at the point where the interior slope of the CRF touches the crown of the tunnel is about 2.5 m and looks too thin to maintain long-term stability against subsidence and caving. The actual thickness of rock cover at this point may be somewhat less than shown if overlain by overburden along this section, and should be confirmed. The height of the tunnel is about 4 m, and I would recommend moving the plug inside the tunnel a bit further, at least to the point where the "2375N" line is shown on the section (an additional 6.5 m in). This would provide a minimum of 4 m of cover, assuming an equivalent span of 4 m for the tunnel.

Note that the active zone ranges from 0.1 m to 1.36 m (GLL 2001) at the site and may be greater in areas of ground disturbance, such as around a tunnel opening. The cover over the other three portals looks good in comparison to the North Portal:

- 1972 Exploration Portal, cover is about 6 m or about 1.5 times tunnel height.
- Main Portal, cover is about 8.5 m or about 2.1 times tunnel height.
- The Conveyor Portal has about 10 m of cover, or about 2.5 times tunnel height.

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I would recommend that Teck Cominco confirm the actual bedrock thicknesses over each portal area to ensure that the plug is positioned in accordance with these recommendations. A minor point that should be mentioned in conclusion is that the plug location itself should be chosen so that there are no structural features within the bedrock past the plug that could become unstable and lead to ravelling to the ground surface, such as faults, broken ground or cavities for example.

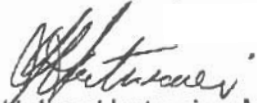
The second issue is with respect to the placement of the cemented rockfill and backfill itself. In order to ensure stability against subsidence and caving, the backfill must be placed tight against the crown of the tunnel, with no voids. The way the specifications are worded allows for "minimizing the creation of void spaces", which means that some voids along the crown are possible. It is difficult to place fill inside a tunnel and completely fill to the top. Although the plugs do not need to be watertight, there should be additional details presented on how the fill will be placed and to quantify the void spaces that will be considered "acceptable to the Owner", as required by the specifications. Teck Cominco should have some experience to draw on from the placement of contaminated soils into the underground drifts.

Closure

As an additional recommendation DIAND/NWB should obtain a copy of the recommendations, if any, made by the Mines Inspector (WCB) of these drawings, so that any additional concerns are noted.

We trust that the above information will satisfy your requirements at this time. If you have any questions or require additional information, please do not hesitate to contact me.

Yours truly,
Per BGC Engineering Inc.



Holger Hartmaier, M.Eng., P.Eng.
Senior Geotechnical Engineer