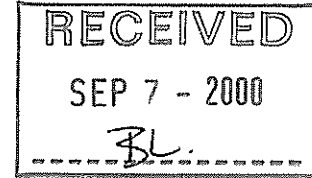




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September 3, 2000

Our File: 4780 005 002

Chairman
Mackenzie Valley Environmental Impact Review Board
P.O. Box 938,
Yellowknife, NT X1A 2N7

By Facsimile: (867) 920-4761

Re: Technical Review of the BHP Diamonds Inc. Proposed Expansion - Sable, Pigeon and Beartooth Pipes

Environment Canada (EC) has reviewed the environmental assessment documentation on the above project. Our review has focused on EC's mandated responsibilities: air quality, climate change, hydrology and water quality, migratory birds, waste management, and cumulative effects. Attached please find EC's technical comments and recommendations for this project.

Please do not hesitate to contact me at (867) 669-4733 with any questions or comments regarding the foregoing.

Yours truly,

Stephen Harbicht
Head, Assessment and Monitoring
Environmental Protection Branch

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Environment Canada's Technical Comments on the Proposed BHP Diamonds Inc. Expansion (Sable, Pigeon, and Beartooth Kimberlite Pipes)

September 7, 2000

INTRODUCTION

Environment Canada is a science-based Department whose business is to help Canadians live and prosper in an environment that needs to be conserved and protected. Contributing to making sustainable development a reality in Canada's North is a priority for Environment Canada. The Department focuses on provision of scientific expertise for incorporation into decisions on developments, such that all parties working together can ensure that there is minimal impact on the natural environment, and that ecosystem integrity is maintained and preserved for future generations.

Environment Canada's role in the review of the proposed BHP NWT Diamonds expansion project is that of a specialist department, and also that of a "Responsible Minister" under the Mackenzie Valley Resource Management Act. Areas of expertise which are brought to this review include: air quality, climate change, hydrology and water quality, migratory birds, waste management, and cumulative effects.

The proposed expansion offers continued opportunities for economic development in the Northwest Territories, if approved. Lessons learned from the development of the EKATI™ Mine must be applied if it is to be developed in an environmentally sustainable manner.

MANDATE, ROLE AND RESPONSIBILITIES OF ENVIRONMENT CANADA

The mandate of Environment Canada is determined by the statutes, regulations, guidelines, policies, federal, territorial, and international agreements, and related programs that it is assigned by Parliament to administer. The overall objective is to foster harmony between society and the environment for the economic, social and cultural benefit of present and future generations of Canadians. The Department shares this goal with other federal agencies, provinces, territories and First Nations.

The Department of the Environment Act provides Environment Canada with general responsibility for environmental management and protection. Its obligations extend to and include all matters over which Parliament has jurisdiction, not by law assigned to any other department, board, or agency of the Government of Canada as related to preservation and enhancement of the quality of the natural environment (eg. water, air, soil); renewable resources including migratory birds and other non-domestic flora and fauna; water;

meteorology; coordination of policies and programs respecting preservation and enhancement of the quality of the natural environment; development of standards and guidelines; promotion of sound environmental practices and providing advice to federal government agencies. In delivering on these obligations Environment Canada has responsibility for specific legislation; regulations; policies and agreements.

Of particular concern and interest for the current project are the responsibilities conferred on the Department by legislation such as the:

- Canadian Environmental Protection Act
- Fisheries Act (Sections 36-42)
- Canada Water Act
- Migratory Birds Convention Act and Regulations
- Canada Wildlife Act
- Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act

Relevant National policies and international agreements include the Toxic Substances Policy, National Pollution Prevention Strategy, UN Convention on Biological Diversity, National Biodiversity Strategy, Arctic Environmental Protection Strategy, Montreal Protocol on Ozone depleting Substances and the National Action Program on Climate Change.

SUMMARY OF REVIEW

Environment Canada's (EC) review has considered the following documents: Project Description Proposed Development of Sable, Pigeon and Beartooth Kimberlite Pipes Oct. 1999; Environmental Assessment Report for the Sable, Pigeon and Beartooth Kimberlite Pipes April 2000; Preliminary Design of Water Control Structures for Sable, Pigeon and Beartooth Kimberlite Pit Developments April 2000; Conformity Response July 2000; Information Requests and Responses dated July 2000 and August 2000; relevant sections of the 1995 NWT Diamonds Project Environmental Impact Statement; and baseline and operational data for the project.

It is the Department's view that environmental issues have been adequately addressed by BHP in their environmental assessment.

Details which remain to be resolved are outlined in EC's technical comments, along with the Department's recommendations.

TECHNICAL COMMENTS & RECOMMENDATIONS

AIR QUALITY

Pollution prevention: Air quality in the territories is generally good. To maintain the quality of our air, the Canadian Council of the Ministers of Environment (CCME) have recognized that polluting *up to a limit* is not acceptable and that the best strategy to avoid future problems is “keeping clean areas clean” (Acidifying Emissions Task Group, 1997 and Particulate Matter and Ozone CWS, 1999). Environment Canada commends the proponent for its efforts to reduce emissions to date and recommends that BHP continues to work with the public, local, GNWT and federal governments to establish programs that apply pollution prevention and best management practices, by, for example:

- developing and implementing strategies consistent with the CCME commitment to pollution prevention;
- ensuring that activities incorporate the best available economically feasible technologies to reduce greenhouse gas emissions, acidic deposition, particulate matter and ozone levels (including all precursors);
- requiring that upgrades carried out in the course of normal capital stock turnover incorporate the best available economically feasible technologies to reduce greenhouse gas emissions, acidic deposition, particulate matter and ozone levels (including all precursors);
- reviewing new activities that could contribute to an increase in greenhouse gas emissions, acidic deposition, particulate matter and ozone levels (including all precursors) with the public, local, GNWT and federal governments in terms of their social, economic and environmental merits.

These activities are consistent with the approaches described in BHP’s Environmental Management plans as described in the EAR.

Recommendation: Environment Canada recommends that BHP continue to maximize the incorporation of pollution prevention measures and best management practices into the proposed development.

Canadian National Ambient Air Quality Objectives (NAAQO): The Environmental Assessment Report (EAR) references the Canadian NAAQO recommendation that the annual total suspended particulate (TSP) concentration should be less than $70 \mu\text{g}/\text{m}^3$. This is the maximum *acceptable* level which is intended to provide adequate protection against adverse effects on humans, animals, vegetation, soil, waste, materials and visibility. On the other hand the maximum *desirable* level defines the long-term goal for air quality and provides a basis for an anti-degradation policy in unpolluted areas

of the country. Compliance with the maximum *desirable* objective of 60 µg/m³ should be the goal in the NWT.

Recommendation: Environment Canada recommends that BHP use NAAQO “desirable objectives” in management planning regarding fugitive dust emissions.

Continued Air Quality Monitoring: Environment Canada commends BHP for its efforts to formulate a thorough monitoring program through the use of:

- dispersion modelling,
- high volume sampling at selected sites,
- mass-balance emissions calculations,
- snow surveys, and
- vegetation studies.

Environment Canada recommends the continuation of this monitoring program, particularly the TSP sampling during the summer months.

In the EAR, the proponent has stated its intentions to continue routine monitoring of CO, NO_x and oxygen during predicted thermal inversions as the pits become deeper. Environment Canada commends BHP for this endeavor.

Recommendation: Environment Canada recommends that BHP continues this monitoring program, particularly the TSP sampling during the summer months. EC would also like to encourage the measurement of inhalable particulates and SO₂ during thermal inversions.

CLIMATE

Documentation of QA/QC procedures: BHP is to be commended for their practice of sending the sensors back to Campbell Scientific for yearly calibrations. However, no attempt is made to discuss error analysis. This type of information is critical and serves to add to the credibility of the data set being collected and reported.

Recommendation: Environment Canada recommends that climate reports include proper documentation of calibration procedures, error analysis, and interpretation, and also identify the corrections.

Clarification of seasonal wind patterns and precipitation patterns: BHP has collected five years of climate data in the project area, but this information has not been used to understand the climate that they are operating in or the implications on certain processes. An example of this is the use of annual wind

roses to predict summer dustfall patterns. The monitoring program should confirm the predictions and provide credibility to the EA process.

Recommendation: Environment Canada recommends that data should be analyzed in a manner suitable to interpret seasonal trends or occurrences. Data so used should be reported in a format which demonstrates relevance to conclusions being drawn.

Climate Change:

According to the IPCC (Watson et al., 1998) Working group II report examining regional impacts of climate change, the most direct changes to the Arctic will be reflected in changes to temperature and precipitation. Trends indicate that the area is experiencing a warming in temperature and increases in precipitation. These changes will have impacts on BHP operations and the environment over the development lifetime of the mine and beyond.

Watson, RT, MC Zinyowera, RH Moss, and DJ Dokken, eds. (1998) The Regional Impacts of Climate Change - An Assessment of Vulnerabilities. Cambridge University Press. 517pp

Recommendation: Environment Canada recommends that BHP incorporate discussions of climate change as part of the reporting procedures

HYDROLOGY

A good understanding of the area's hydrological regime is vital, both in terms of good water management as well as to ensure compliance with water licence conditions. A review of the hydrology information provided in the Environmental Assessment Report (EAR) has identified several concerns.

There are inconsistencies in estimating the water budget terms for the mine site, which include the following:

- 1) Mean annual precipitation as measured at Ekati is 393 mm (pg. 3-7) but for design purposes a value of 345 mm constructed from Lupin/Contwoyto data (Table 2.2-4) is used.
- 2) The EAR uses estimated runoff using correction factors (i.e., 65%) from estimated precipitation; however, there are measured runoff data available. Mean annual runoff estimated from Lupin/Contwoyto precipitation and a 65% runoff ratio is 224 mm, but has been measured as about half that at the outlet of Slipper Lake since 1995.
- 3) There is no justification given for the 65% runoff ratio (Section 2.4, EBA (2000)). Measured data from the Koala basin implies it is much different. There is no justification for the 65% proportion of freshet runoff to annual runoff (Section 2.4, EBA (2000)). Figure 3.3-3 implies that the spring

freshet is more than 65% of the mean annual runoff.

- 4) What is the correction factor referred to in paragraph 2 on page 3-41? Is it to pro rate flow by basin area? Is this reasonable given the problems relating basin area and runoff depth within the Koala basin (see Table 3.3-3 and Figure 3.3-4).
- 5) The only runoff information presented is the 224 mm mean annual runoff value. It is not clear whether this will be used to determine runoff for all sites around the mine including waste rock dumps, Long Lake and Sable Road stream crossings. Given the data presented in Table 3.3-3 and Figure 3.3-4 that shows a shotgun blast relationship between basin area and runoff depth in millimeters, this would be inappropriate.

The inconsistencies in estimating the water budget terms for the mine site made within the EAR are manageable as they result in conservative values of runoff and evaporation. However, these inconsistencies raise additional concerns with the overall level of understanding of the area's hydrological regime, and it is evident that further effort is required. For example, Nipher snow gauge measurements are not necessarily reliable, yet spring snow surveys are not being run. The planned clear water discharge from Long Lake in the mine water balance has tripled from the 1995 EIS to the 2000 EAR. This appears to be due to an unexpected increase in the estimated natural runoff component and a decrease in the annual accumulation of storage in the facility.

Recommendations:

Environment Canada recommends that:

- **Spring snow surveys should be initiated at all sites where spring runoff will impact mine operations (i.e., Long Lake basin and waste rock dumps).**
- **Runoff from these dumps will occur even if the toe berms are installed and a frozen saturated zone is in place within the dump. In fact, the proportion of precipitation that runs off may even increase in the long term as the frozen saturated zone removes potential storage in the dump. If it appears that runoff from the waste rock dumps exceeds water licence specifications, BHP will have to develop appropriate mitigation to control runoff until it can be determined that it meets water licence specifications.**
- **Complete annual and monthly water budgets should be reported under the water licence.**

Regarding the restoration filling of lakes, BHP proposes to conduct filling in such a way so as to avoid significantly impacting downstream flows. However, they do not have adequate data (i.e., streamflow out of Exeter) to support any proposed filling rates or determine impacts. Installation of a hydrometric station should be done where they propose to extract water for the purposes of restoration filling, so that when they wish to fill the pit appropriate withdrawals can be determined.

Recommendation: Environment Canada recommends that hydrometric stations be installed and properly operated at source water bodies which will be used for infilling of pits. The station(s) should be installed for several years in advance of the withdrawals, in order to get the best period of record.

WATER QUALITY

Areas of concern include lake dewatering, effluent and wastewater management, generation of acidic drainage from waste rock piles, stream diversions and lake damming, monitoring of water quality, and pit closure.

Lake Dewatering:

With respect to lake dewatering, water quality concerns should be addressed with the proposed mitigation measures, and by the monitoring of discharge water, and the containment of any water which does not meet licence limits for Total Suspended Solids (TSS).

Recommendation: Environment Canada recommends that real-time automatic water quality monitoring of turbidity and modelling from turbidity to predict TSS levels be considered, rather than relying on grab samples.

Effluent and Wastewater Management:

Effluent quality will be regulated under the Type B water licence which has been applied for. With respect to disposal of minewater from Sable Pit, contingencies need to be identified for water treatment in Two Rock Lake if the effluent quality is not appropriate for release. Dilution capability afforded by the lake will degrade over time, and it may become necessary to use flocculents to meet licence limits. There may be toxicity associated with these.

Recommendations:

Environment Canada recommends that:

- **Licence limits for the expansion be consistent with those set in the EKATI™ Mine Class A licence.**
- **Development of a water treatment contingency plan should be done prior to pit development.**
- **Toxicity testing should be done on minewater from each of the pipes once samples are available.**

The EAR identifies the potential for increases in nitrogen compounds which would be discharged from Two Rock Lake. This is not so much a concern from a nutrient perspective, but if the nitrogen is present in the form of ammonia (NH₃) which is commonly associated with blasting residues, it has the potential for toxicity to aquatic life. The EAR bases predictions for ammonia removal on

the experience of the Long Lake Containment Facility, which has orders of magnitude more dilution available, as well as 2-3 more filter dikes than the proposed Two Rock Lake configuration.

No contingency has been identified for phosphorus treatment at the Sable pit. Although Panda Pit water samples contained very low levels of phosphorus, water quality measurements taken at Sable July 1996 and 1997 showed significantly elevated total phosphorus (possibly as a consequence of drilling activity). Until the concentrations and form (availability) of this nutrient are known, plans should be developed for treatment or alternative disposal of minewater.

Recommendations:

Environment Canada recommends that:

- **Any effluent discharges should be regulated for NH₃ such that aquatic life is protected.**
- **Phosphorus should be a regulated parameter under the water licence.**

Acid Rock Drainage:

Assessment of any acid rock drainage problems associated with the three proposed new pipes requires results from the kinetic geochemical tests which were not yet available. Local geology descriptions for Sable and Beartooth Pipes in Sections 4.1.1 and 4.3.1, respectively, of the October 1999 Project Description mention ARD-benign granite rocks. Section 4.2.1 identifies the existence of potentially ARD-generating biotite schist near Pigeon Pipe. A 1:2,000 scale local geology map of the Pigeon Pipe Area would have been useful to show the location and areal extent of the biotite schist relative to the location of the 13 ARD samples taken (shown in the 1:2,000 scale Pigeon Pit ARD Sample Location plan map (Information Request Responses July 2000)). More petrographic descriptions are required of Pigeon Pit area biotite schists to confirm potential local sources of ARD (e.g. sulphide minerals present and their abundance). Continued investigation of existing static geochemical test results and future kinetic geochemical test results needs to be done.

Recommendations:

Environment Canada recommends that:

- **BHP develop a rock management plan to address the management of all rock that is affected by the expansion. This plan shall describe operating procedures on how all rock will be managed during construction, mining and post-closure.**
- **Rock chemistry data should be provided in support of decisions as they relate to the plan.**

Seepage management:

BHP has proposed the use of toe berms to retain water percolating through the waste rock piles, which will then freeze. Once these internal permafrost zones become saturated, precipitation will more quickly flow through the active layer and emerge as seepage. It is possible that this will limit the amount/duration of contact with potentially acid-generating rock surfaces. Monitoring of seepage from waste rock piles will be required, and a plan for dealing with potential acid leachate from mine rock and tailings should be developed.

Recommendation:

Environment Canada recommends that:

- **As sites are developed, and waste rock piles emplaced, new seepage monitoring stations should be incorporated into the proponent's existing seepage survey program which will identify quality of seepage;**
- **Plans for containment/treatment of seepage should be developed on a contingency basis.**

Channel construction:

Based on the information provided in the design documents, EAR, and information responses, it appears that experience gained in the construction of the Panda Diversion Channel is being well applied to the Pigeon Stream Diversion. Prior to construction, BHP proposes to conduct extensive geotechnical testing in order to determine permafrost conditions and areas of lacustrine silt. This will be necessary to identify potential areas which may be susceptible to thermal or physical erosion. In spite of best construction practices, some introduction of suspended solids will likely occur. The IR response states that if necessary, silt curtains will be used.

Recommendation: Environment Canada recommends that sediment control measures, such as the placement of silt curtains, be required to prevent sediment entering Fay Lake.

Monitoring:

Very little baseline data is available for Fay Lake, which will be receiving waters from the Pigeon Stream Diversion. Monitoring of Fay Lake water and sediment quality should be conducted prior to and during activity in the area.

Bearclaw Lake damming: An impermeable dam will be constructed at the outlet of Bearclaw lake to prevent drainage into the Beartooth pit. Lake levels are predicted to rise up to 2.8 m each year. There may be changes in water quality associated with this "flooding" behind the dam which should be monitored, such as TSS and metals, including mercury.

Sediments: There are sufficient background data collected to identify total metals which naturally exceed the 1999 CCME Canadian Sediment Quality

Guidelines for freshwater sediments (arsenic and nickel). No sediment data were collected for Sable or Beartooth Lakes; however Geological Survey of Canada data collected prior to project activities support elevated nickel levels but not arsenic in the area of these two sites.

Recommendation: Environment Canada recommends that ongoing water and sediment quality monitoring should be carried out on all affected water bodies throughout the development, production, and post-production stages of the expansion and the results be monitored and compared to baseline water quality values and national standards.

Pit Abandonment and Restoration:

BHP proposes to fill open pits and reclaim them as lakes which will support viable ecosystems. The Beartooth Pit is to be partially filled with processed kimberlite (fine tailings) and then filled with fresh water. This will be done on an experimental basis to assess the viability of such infilling as a closure measure. EC supports this on a trial basis, with the understanding that if water quality does not meet guidelines set for the protection of freshwater aquatic life, alternatives will have to be used.

Recommendation: Environment Canada recommends that BHP be required to develop more detailed plans, which include existing examples, for the creation of such meromictic lakes, along with alternative closure methods as a contingency.

MIGRATORY BIRDS

The Environmental Conservation Branch/ Canadian Wildlife Service (ECB/CWS) is in general agreement with the Proponent that the expansion of the Ekati Mine to include the Sable, Pigeon and Beartooth pipes would have minimal impacts on migratory birds at the regional and population level.

There are, however, some concerns with how BHP arrived at their conclusions concerning the expansion's effects on migratory birds. The Proponent has relied almost entirely on baseline and monitoring data collected over the last 5 years to assess the effects of the expansion on migratory birds. In earlier reviews of this data, concerns have been identified with assumptions that were used to make inferences about the data. Specifically, the reporting of breeding territory densities was used rather than simply the density of birds observed (BHP Diamonds Inc., Conformity Response). Nonetheless, results of earlier monitoring studies suggest that, other than direct habitat loss, the present mine is not significantly affecting migratory birds within the immediate vicinity of the mine. Furthermore, if we assume that the breeding territory densities reported by the Proponent are a reasonable measure (index) of relative bird abundance among habitat types then their extrapolation to the entire "study

area" and final conclusions regarding populations at the study area level and beyond likely remain valid.

WASTE MANAGEMENT

BHP will direct all wastes generated under the expansion (including sewage and grey water) to the existing disposal systems,. The Operating Environmental Management Plan covers all aspects of materials and waste management, as well as contingency planning.

Recommendation: Environment Canada recommends that, upon approval of the three pipe expansion, the OEMP shall be updated to reflect changes in operational details.

CUMULATIVE EFFECTS ASSESSMENT

The Cumulative Effects Assessment and Management Framework is currently being developed, and has an implementation target of April 2001. The purpose of the CEAMF is as follows:

The CEA and Management Framework will provide a systematic and coordinated approach to the assessment and management of cumulative effects in the NWT, reflecting the needs of various stakeholders, without prejudice to land claim activities or existing legislation.

Recommendation: Environment Canada recommends that BHP participate in the regional cumulative effects management framework. As a participant in the framework, BHP would make the results of their monitoring programs available for any analysis that is conducted as a component of the framework.

CONCLUSION

Environment Canada believes that should the BHP Diamonds Inc. expansion project be approved, it can be developed and operated in an environmentally sustainable manner provided that BHP:

- Implements proposed mitigation measures, along with the additional recommended mitigation identified;
- Appropriately extends existing monitoring programs for air, ground and surface water, sediments, effluents, and wildlife;
- Utilizes adaptive management techniques as described in their Environmental Management Systems.