

Independent Environmental Monitoring Agency



Ekati Closure and Reclamation Workshop

Final Report

February 14-16, 2006

Author – Dave Osmond

Date of Final Report acceptance – March 28th, 2006

NOT FOR DISTRIBUTION

Table of Contents

Section	Title	Page
1	Purpose and Expectations of Workshop	1
2	Science and Liability of Closure and Reclamation in the North	2
3	Overview of Terminology, Regulatory and Process Considerations	4
4	Objectives, Options, Criteria and Research Items for Selected Ekati Mine Components	7
5	Wrap-up	10
6	Summary of Aboriginal Staff Session	12

Appendices

- A. Presentation By Bill Price**
- B. Presentation By Igor Holubec**
- C. Presentation By Anne Gunn**
- D. Presentation By John Brodie**

List of Participants

Directors	Bill Ross, Tim Byers, Tony Pearse, Sheryl Grieve, Francois Messier
Guest Speakers	Igor Holubec, Bill Price, John Brodie, Anne Gunn
Staff	Kevin O'Reilly, Sean Kollee
Facilitator	Dave Osmond

1. Purpose and Expectations of Workshop

The purpose of the workshop was stated in the notice to participants prior to the workshop and repeated at the beginning of Day 1.

“...to enable the Agency to develop well-informed positions on various aspects of closure at Ekati. The Agency will be in a better position... to provide constructive input into BHPB’s closure planning process and regulatory proceedings...”

The point was made that the Ekati closure planning process is a unique opportunity to work with a mining company that is a strong performer and attempting to work collaboratively. Hopefully, these factors will help in the development of a successful interim Closure & Reclamation (C&R) Plan. Participants were then asked to introduce themselves and at the same time, to briefly state their personal expectations of workshop outcomes.

Expectations are summarized:

- Northern-specific closure planning tailored to local Ekati conditions.
- Overview objectives for closure and have the Agency best prepared to work with Aboriginal Society Members. Information on why each mine component could not be ‘restored’ vs. ‘reclaimed’ or put back the way it was would be appreciated.
- Identify the level of detail required for each stage of closure planning so that the C&R Plan is implementable at anytime for components both already-built as well as those in the conceptual stage of development.
- Dialogue with stakeholders on the early identification of closure options should be considered rather than the proponent identifying and preselecting these on their own.
- Can we accurately predict security requirements based on detailed liability estimates based on generic closure plans that are submitted to regulators?
- Are there design-for-closure options remaining available for the Ekati project?

- It would be beneficial to develop a set of guidelines for closure objectives in view of the large terrestrial mining footprint at Ekati. Proper guidelines for mine closure do not exist in the area of dams and permafrost.
- Want to identify the key questions and the information required to provide answers. Most important part of reclamation planning is establishing and then refining what supporting scientific information is required to make decisions. The objectives of the reclamation plan should be established based on site conditions, mine components, feasible land uses and a community review that includes economic, cultural and, sociological considerations. The process of identifying questions, information requirements and closure strategies is an iterative one. A definitive C&R plan able to address all the objectives sought by stakeholders may not be possible based on the information collected to date.
- Would like the Agency to develop a strong position on what objectives ought to be achieved, and that whatever we recommend is technically sound and achievable. It is not certain that all ideas can be achieved or are ‘implementable’.
- Security cost estimates when developed by individuals can be intimidating. Opportunity to give insight on an estimate that a professional engineer can sign off on is possible in this workshop. Generally, the process includes a massive spreadsheet and experience-based judgements.

2. Science and Liability of C&R in the North

Experts in the fields of mine closure and reclamation, acid rock drainage (ARD), geotechnical engineering, wildlife and reclamation liability presented outlines on key issues and considerations for mine closure and reclamation in the North. Copies of their Power Point presentations are appended.

Important issues and considerations pertinent to Ekati closure and reclamation planning are summarized in the following list:

- Can we really do what has to be done when there are so many details to address?
- Mining may not be a temporary use of land – usually ongoing maintenance, repair, monitoring and site visits are required.
- Impossible to restore to what was there before; in fact, restoration actions may cause more harm than good!
- Many past failures caused by optimistic professional judgement and computer models rather than experience and case histories. Need for solid information emphasized.

- Protection of the integrity of the databases and other site information is critical and essential.
- Contingency plans and adaptive management may be the most cost-effective means of dealing with uncertainty.
- Successful reclamation and environmental protection results from enabling community understanding and constructive input.
- No argument about global warming – just the rate at which it’s advancing; in the case of Ekati, it appears that permafrost will begin to melt within one to two generations.
- Should plan for 200-year long-term time frame. (Diavik designed structures as though they were in Australia – not to rely on permafrost!) Should regulators be reconsidering long-term time-frame definition in the regulatory process?
- Concern that monitoring and maintenance will be required in perpetuity at Ekati owing to a design that relies on permafrost encapsulation.
- Concern about reliance on winter road for access long-term given that winter road seasons are shrinking.
- Closure and liability estimates have built-in uncertainty with likely accuracy of $\pm 20\%$ even at the mid-life stage of a mine. Mine plans can change and so can regulations, etc. all of which can influence C&R costs.
- Costing models must be transparent and in an auditable format to allow reduction in security as a result of successful progressive reclamation.
- It is important to tie the mine’s residual effects on the landscape back to those impacts predicted in the original EA and to update residual effects suspected after eight years of mine operation. This step would help focus closure and reclamation study priorities (e.g., lichen contamination by dust; possible caribou behavioural shifts further than the 5 km originally predicted). This should include revisiting “duration of effect” and “geographic extent”. This step is absent from BHPB’s January 20, 2006 ICRP Terms of Reference, Section 7. It will also be very important to do a post-closure assessment of all remaining residual effects from the mine after remediation and reclamation efforts are completed, to help establish a new baseline against which future changes can be measured and to build public confidence that the area is once again safe for people and wildlife.
- Concern was raised over the ICRP consultation process regarding whether the legal requirement of “weight of accommodation” would be achieved. If “accommodation” really happens during the identification of reclamation objectives and options, then the details will become more readily identified. There is a legal responsibility for governments to consult and genuinely attempt to accommodate Aboriginal concerns, and it is not clear how this will be done and what role BHPB will play.

- Owing to the uncertainty of potential effects on caribou from metals in tailings, it may be prudent to provide a “neutral” landscape rather than a “highly palatable” one. A neutral landscape is neither an attractant nor a deterrent to wildlife species.
- Adaptive management must be applied scientifically and intentionally to help test closure and reclamation objectives now. For example, sequencing pit closure could lead to trials of closure techniques and real information being generated and feeding into the final C&R Plan.

During follow-up discussion of the “science and liability” presentations, three interesting points were made regarding security estimates. The first was that the major difference in the security estimate associated with the first water license and the most recent is due to inflation and to a lesser extent, to expansion of new pits. The second was that closure costs represent a 2-3% cost relative to the lifetime operating costs of the mine. Lastly, the Monte Carlo cost estimation approach is not auditable or measurable and thus it would be difficult to measure progressive reclamation and release any related financial security.

3. Overview of Terminology, Regulatory and Process Consideration

Excellent backgrounds on closure and reclamation goals, objectives and criteria were provided to participants by IEMA staff. As well, the regulatory framework and the approved Year 2000 “*Interim Abandonment and Restoration Plan*” were presented. Time was spent discussing BHPB’s draft ICRP Terms of Reference.

Since all of this information is appended, only significant points made during discussion on these topics are highlighted here.

Terminology

Goal – After lengthy discussion about the goal of mine site reclamation at Ekati, the definition contained in 1994 Whitehorse Mining Initiative seemed to come closest to the mark:

“...returning mine sites and affected areas to viable and wherever practicable, self-sustaining ecosystems that are compatible with a healthy environmental and with (*safe*) human activities...”

Key discussion items to support this conclusion are listed:

- To make the Ekati site safe for people and wildlife, and design closure/reclamation for the long-term (long-term thought of as providing physical stability for 200 years and

thereafter accept gradual degradation whose impact will be acceptable to the receiving environment).

- Reclamation should foster enhanced natural recovery.
- This should occur while aiming to reclaim to a productive end land use and to protect off site land and watercourses while minimizing the need for perpetual care. Walk away solutions should be pursued if possible that are reflective of the original condition of the land and land use, but are rarely possible.
- BHPB's stated goal is to simply to prevent progressive degradation and enhance natural recovery and appears to set a relatively low target.
- Provide robust stable configurations that recognize, or incorporate deterioration and erosion over time.
- Prevent failure and long-term (200 yr.) degradation.
- Reclaim to a productive end land use and protect off site land and watercourses.
- Minimum closure/reclamation design criteria for each mine component.
- Essential to address long-term drainage/surface water management considering that several of the mine components are in the path of considerable upstream watersheds (physical stability to some standard to enable long-term water management).
- Safety for people and wildlife, as close as possible to, or similar to, conditions prior to mining.
- Minimize need for perpetual care, walk away where possible.
- DIAND's stated goal is to achieve physical and chemical stability, aesthetics and an end use compatible with surrounding land uses.

Closure Criteria

This implies that all criteria can be achieved, which is not the case where long-term maintenance is required.

Regulatory Framework

A conflict between BHPB's corporate requirements and those of the water licence was noted. An obligation of corporate management to produce the lowest cost plan that meets the other objectives is something to consider and often, corporate requirements fall short of stakeholder expectations. Accounting standards and accrual accounting must show liability on financial statements. Owner internal estimates may be lower than security posted. Other transparency issues exist. Companies decline to mention or fully disclose reclamation activities at closed sites (a public relations discussion). The regulatory process must take precedence in case of conflict

with corporate standards but the reality is this should not be presumed; thus, the Agency should pay more attention to details of the closure plan.

Concern was raised about the MVLWB review process. Rigid timelines may not allow proper involvement of technical experts. BHPB's development of the closure options on behalf of the communities, or without their active involvement, may be a problem. In other jurisdictions, there would be technical working groups made up of various parties on specific issues such as revegetation, fisheries and ML/ARD. Company consultants would be talking to the government technical reviewers so technical details can be worked out and the best practices are incorporated into the closure plan. The technical decisions are then presented to and reviewed by the stakeholders.

The MVLWB process was discussed. A draft plan is to be submitted by January 2007 and then the Working Group would meet to review chapters. Ideally a conceptual plan should be developed and discussed at the technical level and with the aboriginal people throughout its development. This would lead in having the closure design progressing in the right direction rather than wait for the plan to be submitted before stakeholders are engaged again. There appears to be some fundamental problems with what BHPB and the MVLWB are proposing. Maybe rounds of early discussion on closure plan objectives and options would assist in providing input along the way rather than let BHPB develop a plan in isolation. Proactive technical input must be facilitated rather than have criticisms after company has already invested considerable time and resources into its plan.

Regarding the Working Group's role in evaluating objectives, criteria and options, clarification must be provided about who is responsible for various technical disciplines, do they have the time required and are their credentials appropriate for the task at hand? Some mechanism for balanced technical input should be provided. This may imply a bigger role of the Working Group in the closure plan development process than that currently anticipated.

ICRP Draft Terms of Reference

A discussion took place about the Multiple Accounts Analysis (MAA) and that open-endedness is part of the process. BHPB may not be using the MAA as open-ended as some stakeholders would like. Stakeholders should have a say in developing options rather than have the company develop everything - the "accommodation" aspect of consultation.

Failure Mode Effects Analysis applies to dams and structures and does not deal with metal uptake in vegetation. Risks from closure are not only the result of failure of engineered structures. Biological and process aspects are usually lacking in these risk assessments that focus more on physical issues, such as on spillway structures, blockage, probability of a blockage and flood, would a dam breach and what would the consequence be. The risk assessment should be

collaborative with other stakeholders that value risks other than those a company does. The Working Group could outline a broad list of what the risks are and identify who would be involved with the risk assessment. BHPB's risk assessment work should be reviewed by the Working Group. Upon review of results of effects analysis, guidelines must be provided by stakeholders. On the subject of consultation, BHPB may feel it has accomplished its internal Task 1. Communities have yet to have an opportunity to shortlist options.

4. Objectives, Options, Criteria and Research Items for Selected Ekati Mine Components

To familiarize workshop participants with the main mine component challenges at Ekati, staff provided a brief Power Point overview.

This was followed by a short discussion about the components to be selected for identification of objectives, options, criteria and research needs. There was recognition that participants may not be able to come up with the objectives for all of the mine components, and should involve other interested parties (especially the communities), but the work needs to be initiated. There should be an appraisal of how the objectives relate to one another so that flexibility to compare objectives occurs. The company also has a key role to play in assisting in determining what is possible and affordable.

The participants' willingness to make a statement on the issue of what "long-term" means should be evaluated. If permafrost loss predictions are accepted, then any design option dependent on permafrost encapsulation may not be viable. It has been suggested that structures be physically engineered to last 200 years.

There may be a need for gradation of reclamation vs. alternatives. 'Stable and safe', 'set the stage for natural recovery', 'create productive habitat offsetting losses' were discussed as some basic objectives for reclamation. BHPB's goal was viewed as incompatible with the environmental agreement – to prevent progressive degradation and enhance natural recovery. 'Enhance' is key as it means you cannot just let the site go and do nothing. Minimal concepts include 'safe and secure', 'stable' is a term that is not possible or even desirable biologically. If end land use is a key target then a reclamation goal could start there and then work backwards to discuss complicating factors of technical constraints.

Roads, waste rock and kimberlite rejects, pits and the LLCF were the components subjected to our attempt to identify objectives, options, criteria and possible research needs.

Roads

Generally a 1 m thick gravel or quarry/mine rock pad is advisable for road construction. The natural environment may revegetate this material in the north within some 10 years. Mines often use higher roads embankments to minimize snow accumulation. Mine rock allow cross drainage, as it is coarse boulders. Some roads may have to be left for a longer period to provide access longer term monitoring and maintenance, if required. All culverts have to be removed and historic drainage course re-established. The historic drainage courses and where culverts were used. The drainage should be provided by large swales to the surface of the original ground. Ekati roads are made of mine rock plus crushed cap rather than gravel from esker material. The Fox portal road was made with esker material and shows signs of natural revegetation that may be worth investigating further for the lessons that could be learned.

Roads

GOALS and OBJECTIVES
Enhance natural recovery of revegetation on the roads Should be safe for caribou Restore water flow (historic drainage courses) Preserve key access roads (above objectives may not apply to these key roads) Inventory and classify roads for reclamation purposes and caribou crossing
OPTIONS
Edge sloping 1:3 ratio / small substrate Berm removal Void infilling Some variability acceptable Scarifying may provide source material for some roads Remove culverts and construct shallow sloped swales
RESEARCH
Effects of scarification on caribou health (particularly foot issue – hoof damage and cuts) does scarification provide surface suitable for caribou? Actual rate of natural revegetation and how scarification could enhance revegetation Effect of irrigation on roads to allow freeze thaw Test edge treatments at various linear distances on caribou movement Identify areas where caribou may require better quality of road crossing
COMMENTS
Caribou visual acuity determines spacing of edge sloping vs. coarse edge length Scarifying may provide source material for some roads and enhance re-vegetation Test to determine edge smoothness acceptable to caribou

Waste Rock (and coarse kimberlite rejects)

GOALS and OBJECTIVES
Human and caribou safety (predator/insect access)
OPTIONS
Sloping of edges with smaller granular materials (mixture of slopes) Allow some revegetation on top and edges Collect and treat drainage, if necessary Pit disposal of problem rock Encapsulate within till and clean rock zones
RESEARCH
Inventory waste rock slopes and increased footprint Map best areas for caribou access, seepages Test re-sloping for fine granular materials (cut and fill) Use lake bed sediments What is the contingency if it does not freeze (capping as at Diavik) Metal loading and impacts of unfrozen waste rock
COMMENTS
BHPB should estimate metal loading and if required, develop a mitigation plan One of the reasons we are raising these issues is long-term permafrost degradation. This is a major difference from the original design.

Pits

GOALS and OBJECTIVES
Safety for humans and wildlife Water quality must meet discharge criteria/protection of downstream Create biologically productive lake - granite walls suggests better potential for no water quality issues than most other mines Create productive shore lake habitat Minimize effects on outside water bodies water balance Create shallow lake vs. deep lake
OPTIONS
Create littoral zones at pit edges Accelerate re-flooding with pumping but minimize effects on outside water bodies Implications for tie-in to PDC and Upper Panda Dam Tie in to Panda Diversion Channel and Upper Panda Dam Berming pit Fill with waste rock during operations
RESEARCH
Pit water balance (surplus?) Worker safety of edge works Berm design to avoid caribou impacts

<p>Berm testing and monitoring at Misery (reduced activity) Filling times – reduce the time to fill the pits (minimizes metal leaching) What would it take to make pit lakes biologically productive? Discharge quality</p>
--

Tailings Pond

<p>GOALS and OBJECTIVES</p> <p>Routing management of upstream hydrology to minimize long-term tailings erosion Design surface water management and tailings cover that will minimize long-term erosion Protecting downstream water quality during closure Protection of terrestrial ecosystems Wildlife protection and safety Avoid leaving superfluous dams in place, would require long-term inspection and maintenance if left in place Stability of tailings within LLCF Tailings should be in a stable state (un-erodable) after closure Wind, water and caribou</p>
--

<p>OPTIONS</p> <p>Pump extremely fine processed kimberlite liquids into a pit Provide long-term water diversion around the LLCF Divert water from upstream sources into cell c LLCF durable cover and revegetation No revegetation directly on tailings, need for alternative cover Pump tailings backwards from the dike to have solids rather than water against the dikes</p>
--

<p>RESEARCH</p> <p>Study how to deal with fluffy tailings Study measures to prevent erosion of soft materials at closure Water quality discharge predictions after closure (impact from underground) Have to see new tailings management plans before closure and reclamation Metal uptake and risk assessment related to revegetation</p>

<p>COMMENTS</p> <p>Discourage use of LLCF by caribou if evidence of toxicity</p>

5. Wrap-up

Workshop Report

The report to be prepared was discussed in terms of purpose and audience. The report was said to be written for internal purposes though issues will be brought forth by the Agency in its written submissions, discussions at the working group, and consultations with regulator and the company. There was a general consensus that extensive discussion occurred on many issues of importance. A question raised at the beginning of the workshop (if anything undoable from an economic

perspective had been raised) had been addressed successfully (other than some pit backfill positions considered too expensive).

Items Missed - Analyzing the reclamation based on component-to-component basis some broad issues could have been overlooked such as databases and site knowledge. These may seem less significant but often are the difference between success and failure. Do discharge limits contained in the licence actually capture what is happening or are site-specific discharge limits needed? The group may have underplayed the power of natural recovery of terrestrial environments. Slow natural recovery in the arctic may be necessary and the safest reclamation plan although reclamation activities must initiate the process. How has natural recovery on unused roads progressed?

Workshop Participants Round Table

- The right number and group of people were able to be present to discuss the complex exercise of closing Ekati. Many key issues have been identified. The high level, interdisciplinary focus very fruitful and worthwhile. LLCF slurry issue has been a problem identified from the beginning and smectite clays is a fundamental challenge to settle. It was concluded that BHPB lacks a conceptually viable closure plan for LLCF. Particularly relevant was discussion of lack of progress in settling clays in oil sands
- The presentations were found to be very enlightening. The distinction between closure and reclamation remains an uneasy one. A good job was done with reclamation options and objectives. Outstanding effects and technical problems may result in ongoing unanticipated problems. Community members will have renewed concerns. Meaningful accountability at the end of residual and un-reclaimed effects is needed. Appreciation for the organization of the workshop by staff was voiced.
- Expect agency and communities to benefit largely from this.
- Approval of high quality workshop that was helpful for directors. A promise to share the outcome of this with new directors as they are appointed and with Jaida (off sick). Presentations to the Aboriginal audience will likely be met with keen reception. Long-term issues are more key for Aboriginal than regulator audience.
- Limiting factor maybe BHPB's willingness to change mine plan and engage in meaningful design for closure. Many good ideas have been developed for future. Agency work on reclamation such as incorporating BHPB experts and engineers. Agency has been considering a workshop of this nature for a long time and the agenda was tailored to progress from the last reclamation workshop hosted in 2005.
- Need exists to find a way to keep the consultants in the room today engaged as we move forward. This was a first step and much work remains.

Closing Comments from the Facilitator

It has been extremely beneficial to move beyond the reclamation workshop of 2005 that focused on terminology and general objectives and options for mine components. This work should contribute to good news stories related to the mining industry. The strong presentations filled with key issues, such as ongoing and continuing land use, complexity and need for good science and work, information management and funding, show the challenges that lie ahead.

6. Summary of Aboriginal Staff Session

To allow for some capacity building amongst the Aboriginal Society member staff, the Agency asked the experts to stay over an extra day to meet with staff and repeat their presentations. Staff from the North Slave Metis Alliance, Lutsel K'e First Nation and the Kitikmeot Inuit Association participated.

Some of the key issues raised and discussed are noted below:

- Backfilling of pits is very expensive. Cost estimates at Faro showed that backfilling of ARD rock was about the same cost as capping and water treatment costs.
- Closure considerations for privately owned Aboriginal lands was raised and it was noted that there are few, if any, cases of large open pit hard rock mine closures on private lands in Canada. One of the best ways that community people can help with mine closure is by ensuring government regulators are given the resources to do their job. Approaching the highest levels of senior management can help. The concept of shared risk and reward for the owners of land or those living downstream was discussed. This also leads to differences of opinion as to what standard sites should be left in after mining is done.
- It was noted that there has been little research on lichen composition, mass and contaminant loading generally, and especially in relation to mining in the North.
- Worst-case scenario costing is rarely done and not particularly helpful as always better to conduct proactive mitigation as a preventative measure.
- Employee severance payments are not included in cost estimates for closure.
- Little practical work has been done on developing best practices for waste rock sloping in the North, particularly for caribou.
- Aboriginal organizations have noted that during the assessment phase some wildly optimistic promises are made about mine closure. Can modern mines be developed to allow walk away solutions? The answer to this depends on the site conditions. At a minimum inspection to determine what needs to be done (if anything) will be required on a regular basis. Dams are often featured in modern mines and all dams will require long-term care. Underwater tailings disposal in natural lakes may be a preferred option at some sites to avoid perpetual care yet this is also based on a judgment of what is an acceptable use for productive water bodies.

IEMA Closure and Reclamation Workshop – Final Report

- It was discussed that the cost to the company of properly reclaiming a site could be as low as a few percent of the total costs to operate a mine over its life cycle. The costs of environmental monitoring programs were also discussed. It was noted that Ekati monitoring programs are some of the largest and most expensive in Canada. This is justified by its location in an intact wilderness area and a watershed of significance and quality.
- Incorporation of community input and TK into models was discussed. KIA developed model for reclamation security was also mentioned as similar to the Reclaim method.