Comments on the dAIR/EIS and Updated Project Description for the Raven Project dated May, 2011 regarding the ML/ARD and Effluent Treatment sections

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Updated Project Description (UPD)

Because the project description and mine plan are fluid at this time I will only make broad comments on these.

The product it should be noted is low grade metallurgical coal to be mixed with higher grade coking coal to meet the minimum requirements of metallurgical coal or it is high quality thermal coal, depending on the market. After processing 30 Mt of run of the mine coal it is estimated that 13 Mt of product will be produced, leaving behind 17 Mt of coarse and fine rejects.

The UPD acknowledges the that an application will have to be supported detailed information on ARD prevention but proposes that coarse rejects (all particles greater than 50 mm after breaking) be discharged to the ground for disposal in the coarse reject stockpile. Stockpiles normally indicate something that is stored temporarily while dumps are the normal terminology for disposal sites; the proposal seems to be for dumps.

What seems to be proposed for both waste rock and coal rejects is a landfill blended "to produce an ideal blend". As noted in the appended excerpt from Section 4.5 of the Policy for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia this would require "a grain-by-grain mixing of PAG and NPAG material" to produce a NPAG composite. The Policy also notes major constraints and information and design requirements for blending, all of which should be supported in detail in the Application/EIS.

I have also appended the Guiding Principles from Section 2 of the above referenced Policy and I would like to emphasize that the primary objective of a ML/ARD program is **prevention**. This will be achieved through prediction, design and effective implementation of appropriate mitigation strategies.

Much more information will be required to characterize the geological material and to predict the dynamics of ML/ARD processes than discussed on page 47 of the UPD. The dAIR/EIS recognizes this and ML/ARD prevention and materials management plans will need to be supported by data.

The UPD sites the coal refuse stockpiles and the coal processing facilities over six ephemeral tributary streams and a fish bearing tributary to Cowie Creek but show no water diversions works and gives no detail regarding the settling design criteria nor its size. The settling pond need to sufficient to treat all the process water and all the contaminated runoff from the coal processing yard, stockpile areas and access road during the most intense storm events. The UPD also calls for a polishing pond and catchment ditches which are not shown on any plan. There is no discussion about the possible use of flocculants for effluent treatment.

The Closure and Remediation section of the UPD makes no mention of post closure monitoring nor to measures to be taken for the long term ML/ARD prevention, mitigation and/or treatment.

dAIR/EIS Guidelines

It is very important that the AIR be as complete as possible since the best decision are made with as much information as practical. There will be no opportunity to collect baseline date once the project starts, so as full a set of baseline data as possible should be collected in order to assess some low probability, high consequence situation in the future. Contaminants of high local concern, like cadmium, need to be assessed in full detail if there is any potential of a negative effect. It is in this spirit that I off the following comments:

Section 2.2 – Should there be a second stockpile of “all substrate and glacial till/weathered bedrock till” that is removed from the project and kept in a separate area as indicated in the UPD?

Section 2.2.5 – A benchmark NPR should be established to delineate between PAG and NAG rock. Recent work at Quinsam Coal notes that there is no consensus that an NPR of 2, which is the benchmark noted on page 46 of the UPD, eliminates the potential for ARD as research suggests that the acid drainage potential will be considered uncertain if materials have an NPR of then than 4. The presence of sulphides influences this uncertainty.

Section 2.2.11 – Should include a description of post closure monitoring of all the effected or potentially effected watersheds including any watershed under which the mine passes. Both water quality and quality should be measured to identify any residual effects resulting from the project.

Section 2.7 – Project benefits have to be weighed against the existing economy of Baynes Sound and any potential disruption that ML/ARD production could cause that industry. Of particular concern would be any mobilization of cadmium since oysters from BC waters are very close to the cadmium limits set by many countries for importing this product and any point source discharge of cadmium could jeopardize the area’s economy. The proponent should assess this parameter from a no increase over background levels perspective rather than meeting a set permit limit.

Table 5.3-1 – Should include groundwater recharge areas in or downstream of the work areas, stockpiles and ponds. The Tsable River should be added to the possible watersheds effected.

Section 5.4.1.2 – Water balance special boundaries should include all watersheds subject to subsidence and resultant risks of interactions between surface water, groundwater and mine dewatering processes.

Section 5.4.1.3 – Surface water special boundaries of the Surface Water LSA should include the Tsable River its tributaries which drain the access road and which may carry ARD seepage from mine workings.

Section 5.4.2.1 – The hydrological program should include all other potentially effected creeks where subsidence could effect steam flows (eg: Tsable River and Hindoo Creek).

Table 5.6-1 – Should include potential ARD seeps into Cowie Creek and the Tsable River in the Interactions column. Clams should also be a Species of Focus in this table that may be affected by water and sediment quality.

Section 5.6.1.1 – The LSA should include the Tsable River estuary because of the potential for ARD or mine water seepage because of subsidence induced connections to the surface water. And the RSA should include any watershed that may be subject to subsidence (eg: Hindoo Creek).

Section 5.6.2.1 – The detailed marine baseline should include tissue metal analysis of clams and oysters. Also a Mussel Watch program, a recognized bio-monitoring technique for accumulation of toxins by mussels and other shellfish, should also be established to monitor any bio-accumulation of metals over time.

Section 5.6.2.2 – The Baynes Sound assessment should include the Tsable River watershed because of potential ARD seeps and direct discharge of sediments from access road drainage. Potential changes in the sediment chemistry should also be monitored for the possibility subsequent reprecipitation of ML/ARD products as experienced at Quinsam Coal.

Concluding Statement

The ML/ARD management plan will dictate the economics of the project over the long term. A mine plan which prevents ARD production may cost more up front but will pay dividends in the avoidance of post closure liabilities. Relying on subsequent neutralization of ARD products by excess alkalinity in a blended waste dump may not prevent metal leaching even if the seepage leaving the site is neutral or basic. Once the metal is mobilized it may take costly, long term water treatment to remove it.

Appendix 1

Excerpts from the Policy for Metal Leaching and Acid Rock Drainage at Minesites in BC

The full text of the ML/ARD Policy and Guidelines can be seen at:
http://www.empr.gov.bc.ca/Mining/Permitting-Reclamation/ML-ARD/Pages/default.aspx

2. GUIDING PRINCIPLES

Mining and exploration activities in British Columbia will be regulated in a manner which supports the Province's goals of sustainable resource development, reclamation, environmental protection and minimization of economic risks. To this end, the Provincial Government supports productive mineral extraction while recognizing that the mining industry can only be sustained through environmentally sound, economically viable management practices.

Guiding principles for the regulation of ML/ARD in the Province of British Columbia include:

Ability and Intent - A mine proponent must demonstrate the necessary understanding, site capacity, technical capability and intent to operate a mine in a manner which protects the environment. Mitigation[3] plans must meet the environmental and reclamation objectives for the site and be compatible with the mine plan and site conditions.

Site Specific - The current regulatory philosophy appreciates that every mine has a unique set of geological and environmental conditions and therefore ML/ARD will be evaluated on a site-specific basis.

ML/ARD Program - Whenever significant[4] bedrock or unconsolidated earth will be excavated or exposed, the proponent is responsible for the development and implementation of an effective ML/ARD program. The program must include prediction, and, if necessary, mitigation and monitoring strategies.

Prediction and Prevention - The primary objective of a ML/ARD program is prevention. This will be achieved through prediction, design and effective implementation of appropriate mitigation strategies.

Contingency - Additional mitigation work or contingency plans will be required when existing plans create unacceptable risks to the environment as a result of uncertainty in either the prediction or primary mitigation measures. The timing and degree of preparation required will depend on the risk, when the potential event of concern may occur and the resources required for implementation.

Minimize Impacts - Where ARD or significant metal leaching cannot be prevented, mines are required to reduce discharge to levels that assure long-term protection of the receiving environment. An important secondary objective is to minimize the alienation of on-site land and water resources from future productive use. Impacts and risks must be clearly identified by the proponent and will be considered during the project review process, in conjunction with other environmental, economic, community and aboriginal impacts and benefits. Mitigation is usually more effective if problem prediction and prevention occur prior to the occurrence of significant metal leaching or ARD.

Cautious Approach - Cautious regulatory conditions based on conservative assumptions will be applied where either the ML/ARD assessment or the current level of understanding is deficient.

Reasonable Assurance - The regulation of ML/ARD will be carried out in a manner which minimizes environmental risk and with reasonable assurance that government will not have to pay the costs of mitigation.

Financial Security - As a permitting condition, financial assurance will be required to ensure sufficient funds are available to cover all outstanding ML/ARD obligations, including long-term costs associated with monitoring, maintenance, outstanding mitigation requirements, and collection and treatment of contaminated drainage

4.5 Blending of PAG and NPAG Wastes

Blending refers to the co-deposition of potentially acid generating (PAG) wastes with materials with excess neutralization potential (NP), or non-potentially acid generating (NPAG) wastes. The objective in blending is to create a composite in which the acid produced by PAG wastes is neutralized by excess NP and drainage alkalinity from NPAG materials, with a consequent reduction in metal solubility.

The degree of mixing and the spatial relationship between PAG and NPAG materials plays a major role in determining both the performance and the effectiveness of the blend. Performance is generally maximized when complete, grain-by-grain mixing of PAG and NPAG produces a composite that is entirely NPAG. Where there is some degree of physical segregation between the blended materials, acidic pH conditions are expected to develop to some degree in the PAG material.

Blending has some potential strengths as a mitigation tool, including limited maintenance requirements, compatibility with a wide variety of terrestrial end land uses and in some cases fewer long-term geotechnical concerns (i.e. compared to a water retaining dam) and lower costs. However, blending also has a number of potential disadvantages which currently restrict its use. The type of constraints will, to some degree, depend on the degree of mixing and the spatial relationship between PAG and NPAG materials.

Major constraints include:

Costs - The major constraint for a completely mixed blend of PAG and NPAG wastes are the potentially prohibitive materials handling or amendment costs.

Performance Limitations - Elevated neutral pH concentrations of some metals are possible even if ARD from the segregated PAG material is neutralized. For a well mixed composite, there is the possibility of elevated neutral pH metal leaching from metal-rich sulphides even under neutral pH weathering conditions.

Technical Uncertainty - For a segregated blend, the composite waste performance will depend on the interactions of complex geochemical and hydrological processes, factors which are difficult to study and for which the current understanding is limited. This makes the prediction of water movement and geochemical performance difficult.

<u>Demanding Information Requirements</u> - Blending requires comprehensive material characterization and, in the case of a segregated blend, waste design and construction plans, both of which must be supported by detailed prediction information.

<u>Extensive Material and Construction Requirements</u> - PAG and NPAG materials must have suitable characteristics. NPAG wastes must occur in sufficient proportions and their composition and timing of excavation must be compatible with that of PAG waste. The requirement for detailed operational material characterization may delay excavation, materials handling and deposition. Also, blending often has demanding materials rehandling and deposition requirements.

The acceptability of a blending proposal will depend on the mitigation objectives, site-specific conditions, evidence provided and the proposed design. Blending will only be accepted as an environmental protection tool if supported by detailed design criteria, strong evidence of feasibility and effectiveness, and in the case of a segregated blend, adequate back-up or contingency measures. With a large surplus of effective NP, small drainage inputs and/or low, neutral-pH metal loadings, a blended waste may produce acceptable drainage for discharge. Where site conditions are less favourable, the role of blending will likely be restricted to that of an accessory tool to other more feasible or reliably effective mitigation procedures.

4.5.1 Information and Design Requirements

A proposal to blend wastes must include detailed materials handling and placement plans, supported by comprehensive material- and site-specific testing. A knowledge of the geochemistry, hydrology and consequent long-term contaminant discharge rates are required to set design criteria and determine the potential need and timing of contingency mitigation measures. Since the performance of blended wastes depends on complex site-specific processes, it is not possible to set generic blending design constraints.

<u>Effective Neutralization</u> - Effective neutralization requires NPAG materials with suitable weathering characteristics to be available in sufficient proportions and properly placed relative to PAG materials. Design objectives to improve NP effectiveness include measures to reduce the rate of acid generation, maximize ARD contact with NP and reduce the blinding of neutralizing minerals by iron and aluminum precipitation.

<u>Drainage Reduction</u> - Reductions in the volume and rate of flow of drainage, especially through PAG materials, will maximize NP effectiveness and reduce metal loadings. Placement of the blended waste, especially its PAG components, in a topographic position that limits drainage inputs will reduce drainage discharge. The physical properties and configuration of PAG and NPAG materials within the blended waste can also be used to minimize the leaching of PAG strata.

<u>Material Characterization and Monitoring</u> - The proponent will be required to undertake pre-operational and post-deposition material characterization, and monitor the quality and quantity of drainage and the progress of weathering within the waste. It is essential that the mine plan allows sufficient time to carry out the necessary material characterization prior to material placement or mixing.

<u>Compatibility with the Mine Plan</u> - The proponent must demonstrate that the proposed PAG/NPAG material segregation and blending is compatible with the mine geology and excavation plan. The blending plan must show the relative proportions of PAG and NPAG rock

types excavated during different phases of mine development, demonstrate that the plan is compatible with the mining sequence and indicate that there are sufficient resources for any required materials rehandling. A favourable waste balance, compatible PAG and NPAG material excavation, and the timely availability of disposal sites all minimize the need for rehandling.

Interim and Contingency Prevention/Mitigation Measures - *Where significant uncertainty exists, detailed contingency plans will be required and blended wastes must be placed in a location and manner that permits drainage collection. A contingency plan must include provision of the necessary resources and a monitoring program to ensure timely and effective implementation of the secondary mitigation measures. Sufficient resources must be available to conduct any outstanding materials handling and mitigation requirements for stockpiled PAG waste in the event that a shut down precludes part of the plan. Interim prevention/mitigation measures may be required to delay ML/ARD onset in materials exposed in temporary stockpiles prior to final disposal in a blended dump or impoundment.*

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Work Experience (Not included with submission)

Ministry of Environment - 1971 to 2000

Waste Management Permit monitoring and administration for all the mines on Northern Vancouver Island. Appointed Environmental Surveillance Officer for Quinsam Coal from the time it opened until 2000

Ministry of Fisheries and Agriculture - 2000 to 2007