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APPL. NO. QZ07-078



July 24, 2008

Yukon Water Board

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f. 867-456-3890

Attn: Chairperson Bruce Willis

Dear Mr. Willis:

**Re: Water Licence Application QZ07-078, Alexco Resource Corp.  
Bellekeno Underground Advanced Exploration and Development**

The First Nation of Na-Cho Nyak Dun (NND) has reviewed Alexco Resource Corporation's water licence application for exploration activities at the Bellekeno Mine. This letter describes the results of NND's review which was assisted by Bill Slater Environmental Consulting.

There are several areas, mostly related to waste rock management, where we think that the effective regulatory management of the project would benefit from further details about proposed project components and activities. In these areas, we have suggested that the licence require Alexco to submit additional documentation. We believe that Alexco may have underestimated the reclamation liability for this project, and are recommending that the Board consider the overall liability further before finalizing decisions about security bonding. We are also providing some suggestions for revisions and additions to the proposed monitoring program.

### **1.0 Waste Rock Management**

For the proposed underground exploration project, the management of waste rock is a critical component. Waste rock will be the primary material brought to surface, and most of it will remain on surface permanently after completion of the project. Unless handled properly, waste rock could cause long-term environmental effects through either physical or chemical stability issues. Alexco has recognized the importance of waste rock management for this project and has developed some detailed waste rock management plans.

To ensure that waste rock from the proposed exploration project does not cause deterioration of water quality adjacent to the site, NND recommends that the waste rock management plans and designs be augmented in several areas as described below.

### 1.1 Waste Rock Physical Stability

Alexco proposes to place most of the non-AML waste rock produced at Bellekeno on the steep, north-east facing slope of Sourdough Hill, adjacent to Thunder Gulch. Alexco references an engineering design for the road/waste dump but the application does not provide details about soil conditions or stability of these slopes for placement of waste rock. Given the aspect, the slopes are likely subject to permafrost conditions. Depending on the soil conditions, disturbance of the vegetation and placement of waste rock materials could lead to slope failures and, in some areas, direct effects on nearby Thunder Gulch through increased sedimentation.

Before placing waste rock in these areas, Alexco needs to demonstrate that soil conditions underlying the proposed waste rock dumps/road will not lead to stability issues and unacceptable environmental effects. Should the conditions prove problematic, Alexco will need to identify and utilize alternate waste rock storage locations. The water licence should require submission of design details for the proposed road/waste rock dump prior to Alexco initiating construction.

### 1.2 Waste Rock Segregation Thresholds

Alexco's application provides detailed descriptions of thresholds for segregating AML waste rock from non-AML waste rock. As described in the Waste Rock Management Plan, the distinctions between the two rock types are based on thresholds for calcium, sulphur, lead and zinc contents. These thresholds are based on information about the performance of waste rock over the past 20 – 80 years on the Keno Hill property.

In some cases, the supporting data could be interpreted differently, resulting in slightly more conservative thresholds than those chosen by Alexco. Appendix 2 of the Waste Rock Management Plan describes the lab results used to distinguish the waste rock types based on contents of calcium, sulphur, lead and zinc. From leachate extraction testing, Alexco concluded that any sample showing zinc loading of 10 mg/kg or lead loading of 3 mg/kg or greater could be considered reactive. Also, they concluded that materials with 5000 ppm of either zinc or lead could be subject to metal leaching. These thresholds were chosen based on distinguishing populations within the data sets – where there is a relatively clear distinction between waste rock samples that are reactive and those that are not.

Alexco chose to establish thresholds that identify reactive materials. Based on the same data, it would be more conservative to identify thresholds that define non-reactive materials. With this approach, non-reactive materials would be those where leachate extraction testing showed lead loading of 1 mg/kg or less or zinc loading of 3 mg/kg or less. Similarly, metal leaching generally does not appear to occur from materials that

have lead contents lower than 3000 ppm. The zinc threshold would remain unchanged. Use of these distinctions for developing a waste rock segregation protocol would be more conservative in ensuring that waste rock leaching would not affect local watercourses. Despite providing additional certainty about potential effects, according to the data provided, there would be only minor changes in the amounts of rock identified as AML rock.

Consideration of these more conservative thresholds can be addressed during the ground-truthing of operational segregation protocols as described in the next section of this letter.

### 1.3 Operational Segregation Protocols

Alexco proposes that the calcium, sulphur, lead and zinc thresholds for AML rock can be evaluated by simple field tests and visual observations. Appendix 2 of the Waste Rock Management Plan provides some rationale for the relationship between calcium and the proposed fizz test. For the other observations, the project proposal does not contain any explanation for the relationship between the proposed field observations and the threshold contents of sulphur, lead and zinc.

The proposed methodology will require site geologists to decide about waste rock reactivity on the basis of visually identifying sphalerite greater than 0.75%, galena greater than 0.5%, and pyrite greater than 2% (0.5% in some cases). These visual interpretations will be inherently subjective.

The concept of waste rock segregation based on key parameters makes sense. Unless the waste rock is adequately separated and handled appropriately, the AML waste rock could cause unacceptable environmental effects. Because non-AML rock will be used for construction of the new access road adjacent to Thunder Gulch, effects of poor segregation could include deterioration of water quality in Thunder Gulch and Lightning Creek. From an operational perspective, the waste rock segregation will have to be done using quick field tests and observations, as proposed by Alexco.

In order to ensure that segregation is effective, the relationship between the field observations and the proposed calcium, sulphur, lead and zinc thresholds needs to be confirmed as part of the program. This confirmation should be done immediately upon start-up of the exploration program. It should involve segregation of waste rock using the proposed protocol (field tests and observations) in combination with sampling and analysis of waste rock to confirm the calcium, sulphur, lead and zinc contents. Based on the results of laboratory analysis, the segregation protocols should be adjusted as necessary to ensure effective segregation according to the thresholds, preferably the more conservative thresholds described above. The results of the laboratory analysis should be used to adjust the field program to ensure compliance with thresholds. Once the initial confirmation program is complete, the overall management plan should include periodic confirmatory sampling to ensure that segregation is still occurring as planned. This would be especially important if the staff responsible for segregation decisions were to change.

To address the need for ground-truthing of the proposed operational segregation protocols, the water licence should include requirements for Alexco to provide a description of initial and ongoing confirmation testing programs. The results of the initial program should be reported in a stand-alone report, while the results of ongoing programs can be reported as part of the annual report. The initial program should also include analysis of the implications of utilizing the more conservative thresholds described in Section 1.2 of this letter.

## **2.0 Reclamation**

### **2.1 Waste Rock Reclamation Approaches**

Alexco describes the reclamation of the non-AML waste rock dumps as part of its description of reclamation methods for roads and the portal pad. Generally, Alexco proposes reclamation that will include drainage recontouring and surface scarification. The reclamation proposal does not include placement of soil or nutrient materials to encourage growth of vegetation, or any active re-vegetation activities. As a result, the storage of non-AML waste rock will result in long-term (perhaps permanent) disturbance of local vegetation and land which may lead to ongoing sedimentation issues.

For the AML waste rock, Alexco proposes covering with one-half metre of compacted soil. The intent of the cover is to shed water away from the pile and reduce infiltration into and through the reactive rock. The application identifies the general source of materials for cover construction and provides some nominal information about the material properties and construction methodology. Alexco proposes placement of materials with compaction by dozer. No details about construction monitoring or quality assurance/quality control are identified. Alexco suggests that a permeability of  $10^{-3}$  m/s can be achieved with the proposed materials and compaction approach. Permeability of  $10^{-3}$  m/s seems high for consideration of a cover for AML material.

As with the non-AML waste rock, Alexco does not propose any active re-vegetation activities. However, for a one-half metre thick cover in a cold climate, vegetation will be critical to reducing infiltration. A more detailed cover design that describes cover materials, construction methods, vegetation establishment and expected performance is necessary to support understanding and evaluation of potential for long-term metal leaching from the AML waste rock to affect local ground and/or surface waters.

To address the need for a better understanding of proposed reclamation methodologies, and ensure that reclamation activities will achieve appropriate objectives, the water licence should include a requirement for Alexco to submit a more detailed closure plan that considers the above issues and concerns and incorporates more design details about the cover proposal for AML rock. Reclamation methods for existing waste rock dumps at the Keno Hill property have not yet been developed. However, mechanisms for re-vegetation of the waste rock dumps are being investigated in closure planning studies.

The proposals for reclamation of waste rock for the Bellekeno exploration program need to be consistent with those for long-term decommissioning at the entire site.

## 2.2 Reclamation Liability

Alexco's water licence application provides an estimate of the reclamation liability associated with the Bellekeno exploration project. Because of our concerns about the adequacy of the proposed reclamation approaches for waste rock (Section 2.1), the reclamation liability estimates provided by Alexco appear to under-estimate the actual costs that would be incurred for completing the reclamation.

Because the new access road will be constructed from waste rock, it is likely that placement of growth medium and active re-seeding will be required to ensure effective re-vegetation of this area. Costs for this activity should be included in the estimate of liability. If borrow areas will be required, the development and reclamation of these areas also needs to be addressed.

For the AML waste rock, Alexco proposes a cover that will minimize infiltration. Achieving this objective will likely require a cover that is substantially thicker than the ½ metre cover currently proposed. It may also require soil materials with lower permeability. Active re-vegetation of the cover material will likely be required to ensure that it can function effectively as a store-and-release cover. The costs for construction of a cover that meets these requirements will be substantially higher than those identified in Alexco's estimate and should be considered in finalizing a reclamation liability estimate. Depending on the types of soil materials required, costs for borrow source development and reclamation may also be required.

NND recommends that the water licence require Alexco to furnish a security bond that is adequate to address the reclamation liability on the site at any point in time. The estimate of reclamation liability utilized to establish the amount of security needs to consider a detailed evaluation of closure costs including the issues identified above. The estimate of reclamation liability also needs to include costs for post-reclamation monitoring. NND recognizes that Yukon Government may hold security under other regulatory instruments and understands that security held under a water licence may be adjusted to reflect other security requirements.

## 3.0 Monitoring

### 3.1 Monitoring for Ammonia

Because of the blasting activities, Alexco's project proposal identifies ammonia as a contaminant of concern in water discharged from the exploration project. Alexco proposes an effluent limit of 5.0 mg/L. For the temperature and pH conditions at this site, ammonia at this concentration is not likely to be toxic to aquatic organisms and the concentrations in Lightning Creek will likely meet the Canadian Water Quality Guideline for the Protection of Aquatic Life.

To ensure that ammonia does not exceed the proposed limits and affect aquatic ecology, the monitoring program needs to include sampling and analysis for ammonia to confirm that the discharges meet the proposed effluent limit. The water quality monitoring program described in the application and the draft licence should be expanded to include ammonia monitoring. Ammonia monitoring should be added to the monthly external monitoring for sites KV74 and KV75. If water is transferred from Bellekeno East to the existing Bellekeno treatment system, ammonia monitoring should be added to the monthly external monitoring at site KV43. Site KV42 should also be included if blasting is occurring in areas that will affect water that is pumped directly from the underground workings to the existing Bellekeno treatment system.

If the monthly monitoring shows concentrations that are near the effluent limit, the monitoring program should be revised to include ammonia as part of the daily on-site monitoring program for discharge sites (see Section 3.4 of this letter).

### 3.2 Monitoring – Thunder Gulch

Alexco proposes relocation of sample site KV65 from its current location on Thunder Gulch upstream of the Bellekeno 625 adit to a new location on Thunder Gulch upstream of the Bellekeno East adit. To allow future interpretation of data, overlap sampling at both locations would be prudent for a period of at least one year.

### 3.3 Monitoring – Waste Rock

The water quality monitoring program described in Section 5.3 of the Project Proposal does not include monitoring of waste rock seepage. The Waste Rock Management Plan (Appendix D) does propose some monitoring of waste rock seepage.

Seepage from waste rock could lead to effects on Thunder Gulch, especially if the seepage contains elevated metal concentrations. Alexco proposes monthly monitoring of waste rock seeps for field parameters that include pH and conductivity. These parameters provide some guidance about seepage quality, and are likely sufficient for the proposed monthly program. However, it would also be useful to have an understanding of metal and ammonia contaminant concentrations in seepage from all types of waste rock – AML, non-AML and mineralized. Twice annual analysis for metals and ammonia would likely be sufficient if carried out in combination with the proposed monthly program. The more detailed analysis should be completed for samples collected in spring (when flushing may occur) and in late summer.

The monitoring program identified in the draft licence should be expanded to include the waste rock seepage monitoring, which is not currently included.

### 3.4 Daily Operational Monitoring

The water licence application (p. 5-4) proposes daily monitoring for select sites and parameters. This monitoring is not identified in the draft licence. Analysis for the daily monitoring will be done internally and the data will be used to guide operational decisions. The daily monitoring program is critical to ensuring that effects do not occur in local watercourses, and the requirements for this monitoring should be included in the licence.

### 4.0 Closing

We hope that the information contained in this letter will assist the Board in completing its deliberations related to Alexco's water licence application. If you have any questions about the issues, concerns or recommendations described above, please contact us.

Yours sincerely,



Dennis Buyck  
NNDFN Lands Director

cc. Alexco Resource Corporation