



Pacific & Yukon Region  
Mile 91782 Alaska Hwy.  
Whitehorse, Yukon  
Y1A 5B7

29 December 2004

YUKON

2004 DEC 29 PM 4:52

APPL. NO. Q201-051

Judi White  
Manager, Water Board Secretariat  
Suite 106 - 419 Range Road  
Whitehorse, Yukon  
Y1A 3V1

Dear Judi:

**RE: Water Use Application QZ01-051 Advanced Exploration Wolverine – Type B Licence**

Environment Canada has completed its review of the above referenced licence application. We have attached our recommendations for the Board's consideration. These are also our comments for the EA screening.

Environment Canada does not request a public hearing.

Respectfully

Vic Enns P. Eng.  
Head, Pollution Abatement  
EP - Yukon

(403)667-3403 (o); (403)667-7962(fax)

cc. M. George – YTG Environment  
A. von Finster – DFO  
H. Meade – Expatriate Resources (fax 604-682-5404)  
J. Ceasar – RRDC (fax 867-969-2405)



Environment Canada  
DRAFT Intervention/EA Screening Comments

Type B Water Licence QZ01-051

Advanced Exploration Wolverine Project  
Expatriate Resources Ltd.

## 1.0 BACKGROUND

This project is a key preliminary component in Expatriate's efforts to establish the feasibility of moving the Wolverine Mine site into production. The broader initiative to obtain a Type A water licence for the production mine is currently just entering the Environmental Screening process. A significant portion of the information required to complete the screening of the Type A licence application, will be obtained through the advanced exploration program. Expatriate's production decision will depend in large part on the results of the advanced exploration program.

The advanced exploration project entails the completion of about 3500 ft of underground decline which would ultimately also be used to access the ore body if the mine itself is eventually commissioned. Approximately 78,000 tonnes of rock, including 22,000 tonnes of ore, will be brought to the surface as part of the advanced exploration program.

The recommendations Environment Canada (EC) is making for this Type B licence should not be viewed as precedents which will be applied to a Type A licence for the mine operation. We believe, both the company and the regulators recognize that there are some significant information gaps which need to be filled. In the absence of this information we believe the following advice is reasonable.

## 2.0 RECOMMENDATIONS

### 2.1 Effluent Standards

The results of grab samples analysis of any waste discharge should not exceed the following standards:

Arsenic	.10 mg/l
Cadmium	.02 mg/l
Copper	.20 mg/l
Lead	.20 mg/l
Nickel	.50 mg/l
Zinc	.50 mg/l
TSS	15 mg/l
Ammonia	2.50 mg/l
Selenium	.015 mg/l

Fish Bioassay: 96 hour LC<sub>50</sub> as per Environment Canada Method EPS 1/RM/13.

Y W B

Rationale:

There are several principles on which the setting of effluent standards can be based, including: a) how much loading can the receiving environment tolerate and still achieve CCME aquatic life protection criteria; b) within the Yukon, what levels have been demonstrated by the mining industry to be readily achievable with proven technology; c) what levels have been shown to be consistent with best practicable technology in reasonably similar environments elsewhere in the mining industry. The effluent standards we have proposed above are those which have been applied to Yukon mine sites for the past 20 years or more and which have been demonstrated to be readily achievable. Expatriate has proposed that the standards in the Metal Mining Effluent Regulations (MMER), which are administered by EC, should apply. The MMER standards are the least stringent effluent standards which are allowed for operating mines in Canada. The MMER itself will not apply to this application. The MMER does come into play once a mine is in production but typically the territory and provinces set more stringent effluent requirements.

## 2.2 CCME Water Quality Objectives

Station W16 will be the reference site for receiving water quality monitoring for the purposes of assessing whether the CCME aquatic life objectives are being achieved in Go Creek.

Rationale: This is the site in Go Creek proposed by Expatriate and we believe this makes sense given that it is readily accessible.

## 2.3 Water Quality/Quantity Monitoring Program

The program proposed by Expatriate on page 20 of their 19 Nov. correspondence to the YTWB is recommended with the following additions:

- Station W12 should be added with the same parameters as W16 but on a quarterly basis.
- Station W9 should be included with the same parameters and frequency as W12.
- Dissolved Organic Carbon (DOC) should be measured at Stations W9, W12 and W16.
- If the portal is discharging then the winter monitoring should be at least monthly for all stations except W12 and W9. If there is no surface discharge from the property then only quarterly at the receiving water stations is required.
- Quarterly bioassay sampling of effluent if discharging.

Rationale:

Station W12 is Go Creek above the confluence with Money Creek. It will be important to assess whether Go Creek could have a measurable impact on water quality in Money Creek.

Station W9 is added since the point of discharge from the portal is into a topographical divide and there may be some uncertainty related to potential effects on Little Wolverine Creek.

DOC is recommended for addition to the receiving water stations as it will be an important parameter for assessment of potential aquatic effects in the longer term.

The application was ambiguous about the frequency of any winter monitoring (October – March). Regular monitoring should continue if project discharges are still occurring. In the absence of

Y W B

obvious discharges then quarterly receiving water discharges should still be maintained in order to establish baseline data to enable future assessment should winter discharges occur at some point and to verify the extent to which the project may continue to have effects in the winter due to groundwater effects or long lag times in the environment.

#### 2.4 Term of License

Recommendation: The term of this licence should be for about 10 years.

Rationale: The application does not seem to suggest a licence term. We recommend about ten years since, in the event the mine does not proceed to production, we will be passed the 5 year trigger for implementation of permanent closure (see section 2.8 here) and this is enough time that there should be adequate knowledge for prediction of long term flows, contaminant release, and long term effects.

#### 2.5 Quantity of Water Use

We do not object to the application's proposed maximum allowable water discharge of 203 m<sup>3</sup>/day.

Effluent discharge rates should be timed in accordance with the proposal in section 6.1, page 36 of the application which links the discharge rate to the available dilution at station W16.

Rationale: Given the uncertainties respecting contaminant loadings, pathways and the assimilative capacity of the receiving environment it is appropriate to keep the flows as low as is reasonable under the circumstances.

#### 2.6 Provision of Water Treatment

Recommendation: Within 30 days of licence issue the proponent shall submit an interim water treatment plan which details the methodology, equipment and controls which will be in place and demonstrates that effective effluent treatment will be available on site upon the commencement of the development of the portal. Within 90 days of the commencement of portal development, a water treatment plant similar to that described in Appendix A-1 of the Application must be operational. Within 90 days of the commencement of portal development, a treatment plant operating manual and detailed plans will be submitted to the Board to document, for example – the results of the treatability testwork; the design of the facility; details on how water will be routed to and from the treatment facility, and; contingency provisions for winter operation. Expatriate will notify the Board of the date of commencement of portal development not later than 7 days following such commencement.

Rationale: On page 15 of the 2 Nov 04 company response to YTWB questions, it is indicated that the design of the treatment system will not be finalized until sometime after the commencement of the underground development. This is consistent with the recommendation in Appendix A-1, p. 1.0 that at least a bench test is required to finalize the design parameters for the treatment system. Our concern is that there is a chance that flows of poor quality water from the underground may develop quickly. In correspondence with the Board, the company suggests that some interim ability to treat will be provided from the outset of development. Whatever

Y W B

product is used to treat the wastewater, it will be necessary to make specific provisions to ensure it is very well mixed with the discharge in order ensure effective treatment and also that the pH is kept within the acceptable range. The 50% w/w caustic proposed for use will be in a very viscous form and is hazardous to handle. Details of the company's strategy for ensuring effective interim treatment should be documented.

## 2.7 Financial Security for Reclamation

The company acknowledges that a) there is the possibility that the underground workings will discharge in perpetuity, and b) that the discharge may require some form of treatment. How treatment may be achieved is only very conceptually discussed and the feasibility of the proposed 'bioreactors' and wetlands is unproven. This puts government in an awkward position with respect to financial security requirements. Once the underground flow is established the potential for an eventual portal discharge exists and if the company experiences financial collapse at any point thereafter, any liabilities could fall to the taxpayer. Government, on all levels, supports the 'polluter pays' principle. The Yukon Water Board should establish initial reclamation security requirements as best it can with the information provided and in light of the intrinsic uncertainties. Although eventually we may find: a) that there is no discharge from the portal, or; b) that the water which may discharge is, and will remain, environmentally benign – but this outcome should not be presumed. In section 2.9 following, we are recommending the company be required to submit Temporary and Permanent Closure plans. Those plans must include cost estimates for the implementation and operation of these closure facilities. Those costs should be critically reviewed by the Board and stakeholders and the licence amended to incorporate a schedule for the provision of reclamation security and for the Board to adopt the plans into licence including any accepted changes to the proposed plans. Such an amendment would not require a mandatory public hearing under Type B licence rules.

## 2.8 Temporary Closure

In section 3.2 of Expatriate's 19 Nov 04 response to the YTWB, it is proposed that temporary closure will become permanent after a continuous temporary closure period of 5 years. EC supports this proposal. We would recommend using the resumption of underground mining as the triggering activity for interruption of the temporary closure period. Otherwise there could be some ambiguity about what level and types of activity constitute an interruption of temporary closure and a re-setting of the 5 year temporary closure clock.

## 2.9 Closure Plans

**Recommendation – Temporary Closure:** Within 60 days of the effective date of this licence, the company will submit a plan for the temporary closure of the works authorized under this licence. The plan should have enough detailed information to permit a reliable determination of feasibility, performance and costs. This closure plan will include, as a minimum: an updated water quality model; contingency plan in the event the portal eventually has a discharge and requires year-round water treatment; a cost estimate for closure based on completion by third party contractors; mitigation for all components of the works to ensure longterm physical and chemical stability.

**Recommendation – Permanent Closure:** Within eight months of the commencement of portal development under this licence, the company will submit a plan for the permanent closure of the

Y W B

works authorized under this licence. Expatriate will notify the Board of the date of commencement of portal development not later than 7 days following such commencement. The information requirements for the plan are the same as those listed for temporary closure except the emphasis will be on meeting the very long term physical and chemical stability objectives for the site. As well, as far as possible, the objective should be to minimize requirements for active care and maintenance during permanent closure.

Rationale: Expatriate anticipates that within the next 1 to 2 years there will be a 'go' or 'no-go' decision regarding the development of a mine at this site. This Type B licence should not presume that the eventual granting of a Type A licence will mean that a mine will indeed be built and that we can rely on the Type A licence to define closure requirements. If a Type A licence is granted the mine still might never go into production and a closure plan just for the works under this Type B licence would still be needed. It is tempting to push the timeframe for the development of the closure plan for the Type B works out beyond the decision point for the Type A licence, anticipating that it might be overtaken by the development of the mine, should that proceed. We recommend that the timing for this closure plan should not be tied to a future decision regarding mine development. If the company will be proposing any site specific receiving water quality criteria it will be important to ensure that proposal is supported by good information on the relevant sensitive receptors in the receiving environment.

Again, these plans should be critically reviewed by the Board and stakeholders and the licence amended to incorporate a schedule for the provision of reclamation security and for the Board to adopt the plans into licence including any accepted changes to the proposed plans. Such an amendment would not require a mandatory public hearing under Type B licence rules.

#### 2.10 Sludge Disposal Plan

Recommendation: Within 120 days of the commencement of water treatment at the portal Expatriate will submit to the Board a plan for treatment sludge stabilization and disposal. Expatriate will notify the Board of the commencement of water treatment within 30 days of such commencement.

Rationale: Expatriate will need to know the actual characteristics of the sludge in order to develop a final sludge disposal plan.

#### 2.11 Studies

The application makes reference to several studies which will be initiated during the course of the advanced exploration project. We recommend that reports detailing the results of these studies be tabled with the Board within one year of the commencement of portal development.

#### 2.12 Appendix E Spill Response - In the "Spill Contingency and Emergency Response Plan":

- a. it should be emphasized that any chemical or petroleum spill into water should be reported immediately, regardless of the amount. The "Small Quantity Exceptions" referred to from other jurisdictions do not apply here in the Yukon. The applicant should update their plan to reflect Yukon Environment Act requirements (Spills Regulations, Schedule A).

Y W B

b. Part 10 Telephone Lists of Government Agencies for Reporting Spills: "Environment Canada" and "CANUTEC" are different agencies and should be listed separately (CANUTEC is part of Transport Canada). Contact information for this office should be included (Local office phone number: 867-667-3400, fax: 867-667-7962). The list refers to the "Department of Indian Affairs and Northern Development" (DIAND). The list should be updated to reflect devolution of regulatory and inspection responsibilities from DIAND to YTG.

### 2.13 Sediment Monitoring

Recommendation: Triplicate sediment samples at W9, W12 and W16, during summer low flow, annually. The samples should be analyzed for metals in the sediments <70 um for comparison with baseline studies.

Rationale: Sediments in the smaller fraction size react more readily to disturbances and is a very useful method to track contaminants in the receiving environment. The stations are directly downstream of the advanced exploration project. Some results are already provided from the baseline for comparison. If changes are to occur it will do so in a short period of time and an annual program is adequate in this case to record site disturbances and changes to sediment quality due to water quality of the effluent and suspended solids.

## 3.0 GENERAL COMMENTS

### 3.1 Water Quality Model

The work that Expatriate has done to attempt to predict the water quality from the underground and from the ore and waste rock storage area is necessary and helpful. We would like to point out some of the limitations inherent in these predictions.

a) Little Wolverine Creek used as 'Worst Case' for water quality model.

While it is true that this water is the worst quality among those samples reported, there are some significant uncertainties surrounding its use as worst case water quality for any eventual underground discharge. This water quality comes from Station W9 which is low down in the Little Wolverine Ck drainage. The ore zone occupies a small part of the watershed on one side of the drainage about 2.5 km upstream of this sample station. Any water contacting the ore zone could be a small fraction of the groundwater discharge to this creek. Expatriate states that a large part of the creek flow seems to come from seeps in the vicinity of the ore zone but no data is offered on the water quality of these seeps nor the dilution in the creek between the area of the ore zone and W9. Once mining has advanced to the ore zone and infiltrating water comes into contact with the orebody and fines produced by blasting and other mining activities the water quality could be worse than even the quality of any existing surface seeps.

b) Waste rock seepage quality is calculated based upon metals release from two humidity cells. The tables presented do not indicate the particular rock-types tested, however the two major hanging wall units (rhyolite and argillite) are indicated in the text. We note that the waste rock storage area will also contain ore, as indicated, and it is expected that metal release will occur from this rock mass as well. Because metal release from ore is not accounted for, Table 3 presents a predicted water quality from waste rock storage which is not conservative. This is important because this information is further used for managing water (e.g. adit groundwater discharge) on the site: as detailed further in the text. These calculations will need to be revisited accommodating relevant humidity cell information for the ore component of stored waste. The text also suggests that iron formation from the hanging wall will also report to waste – there is little information regarding geochemical stability of this rock unit, and thus similar concerns

apply to integration of this unit within the waste storage area.

c) Section 5.1.2 of the July 2004 application includes the equations used to generate the water quality predictions and Expatriate's estimates of how much water could be discharged and still achieve CCME objectives at site W16 in Go Ck. Term GQ (Groundwater quality) is assumed to be equivalent to Wolverine Creek low-flow quality. Our concerns with this assumption are outlined above. Seepage flows and quality in the underground will be monitored and the input value for the Groundwater quality term revisited with possible adjustments to both the value of the term used here and thus the computed value for maximum allowable groundwater flow (GF).

d) The term SQ in section 5.1.2 (Waste rock seepage quality) is based upon the average quality of hanging wall rock from humidity cell testing. As noted above: there will also be ore produced with this project which will be stored along with other waste rock in the containment cell, thus SQ will be underrepresented by the degree to which contaminants will report to seepage from ore. We recognize that there may be a delay factor, however there is no information available to quantify that possibility. The maximum allowable groundwater flow (GF) will have to be recalculated accordingly. There is also a term in this model (EQ) which is not explained in the text: this needs to be explained. Also, we note that both model outputs (BQ presented initially, and GF) will need to be recalculated because of the concerns noted above. Some adjustment to the dewatering rate will be necessary once there is a better understanding of groundwater quality.

e) Estimates for the release of nitrogen (ammonia is the main nitrogen component of concern because of its toxicity) from blasting residues are provided in section 5.1.3. The Ferguson and Leask model assigns losses of .94% for ANFO and 5.1% for the emulsion (or slurry) form of ANFO. This may seem counter-intuitive since the emulsion is used because it is less susceptible to ignition failure in wet environments and yet it shows the highest nitrogen losses. If ANFO (which is cheaper) were used in wet environments, the ANFO losses would have been much higher than those reported for emulsion. So, it is not the ANFO has intrinsically lower nitrogen losses – it is that ANFO must only be used in dry environments and the emulsion in wet. It should also be noted that the Ferguson model was developed from data at very large open pit coal mines in southern B.C. Underground workings can be more vulnerable to accidental spills and mis-fires creating higher variability in the nitrogen content of the effluent discharge.

f) The concept for permanent closure of the underground proposed flooding as key mitigation (section 7.4.3.2 of July 2004 application). While it is true that subaqueous disposal is the best means to prevent acid rock drainage, it is also recognized that some metals, such as selenium and sometimes arsenic, are released through dissolution mechanisms which do not stem from ARD. These metals can continue to be released in sub-aqueous environments. As well, the underground can only flood to the level of the portal and no higher. The workings may intercept highly water conductive faults draining ARD zones from higher up in the mountain. Contaminants from such sources would continue to report to the portal discharge after flooding.

### 3.2 Blending of NAG/PAG rock

On page 12 of the July 2004 application Expatriate states that the possibility of blending the waste rock NAG and PAG materials will be investigated as a means of reducing ARD. Section 7.4.3.2 states that only 60% of the waste rock can be returned to the underground at permanent closure. It is not clear how blending will be consistent with the desire to ensure that all the PAG materials are disposed of subaqueously. Subaqueous disposal will be more effective than blending for the long term chemical stability of the PAG wastes.

Y W B

### 3.3 Treatment System Settling Ponds

There does not appear to be any information on the liner design for the 5 cell settling ponds for clarifying the treated wastewater. This should be clarified. If the ponds leak excessively it will be difficult to manage this system effectively.

Y W B

QZ01-051