

RESPONSIVENESS SUMMARY

Responses to 2nd Addendum to the Buckhorn NPDES Fact Sheet and Permit
June 24, 2009

Response 1.

Geochemical modeling data identified contaminants that were predicted to approach or exceed NPDES effluent limits. Based on Crown's experience at the K2 mine, nitrate was acknowledged as the contaminant that clearly would exceed the NPDES permit effluent limits and thus be the primary driver for the treatment process. Based on experience at the same mine, the concentration of ammonia in the mine water was also predicted to exceed NPDES limits. Concentrations of other contaminants, such as metals, were also predicted by geochemical modeling. Metals concentrations were predicted to be site specific depending on the geology and mineralogy of the ore as it was mined. For example, modeling predicts a substantial difference in the metals characterization of influent to the treatment plant from the Gold Bowl mine workings compared to that currently pumped from the Southwest Zone mine workings.

Using this predicted water quality, Crown prepared the AKART engineering report to identify the treatment process for removal of all contaminants, not just nitrate. Reliability and flexibility were important considerations in the analysis. Ion exchange was the process selected. Bench scale testing identified the number of ion exchange columns and the types of resins necessary to achieve NPDES permit limits. A four column treatment system was selected, with one column specifically designed to remove ammonia. Thus, the AKART engineering report did account for ammonia removal along with other contaminants such as metals and arsenic. Subsequent experience with the actual mine water disclosed that the prediction for nitrate and most metals was reasonably accurate but the ammonia prediction was too low. The addition of breakpoint chlorination as pretreatment for the ion exchange treatment plant is intended to rectify that error.

Following an administrative order from Ecology, mine water quality influent to the treatment plant from the Southwest Zone workings was analyzed for comparison to the water quality predicted by geochemical modeling. In a technical memo dated October 22, 2008, that analysis concluded that the treatment plant influent exceeded the modeled concentrations for zinc, chloride, and sulfate, but through operational flexibility of the ion exchange treatment system NPDES effluent limits for discharges from the treatment plant have been met for those parameters.

The primary effect on the treatment system when influent concentrations are greater than modeled is to require more frequent regeneration of the ion exchange resins that target and remove each specified contaminant. The Treatment Plant Operational Monitoring Plan establishes the frequency for internal process control monitoring of the discharge from each ion exchange column to track the effectiveness of the resins to remove each contaminant. As the treatment efficiency of a resin decreases, the concentration in the effluent increases. At a predetermined concentration, less than the NPDES permit limit, the resins are regenerated. The frequency of regeneration is thus driven by the influent concentrations.

Breakpoint chlorination treatment for ammonia is used elsewhere. It is used to neutralize ammonia at wastewater treatment plants and swimming pools. Chlorine is widely used to disinfect drinking water. For drinking water disinfection, the state Department of Health mandates a Total Residual Chlorine (TRC) concentration of at least 0.2 mg/L, compared to the NPDES TRC effluent limit of 0.008 mg/L (chronic) and 0.019 mg/L (acute). Crown's use of breakpoint chlorination is as pretreatment; the final treatment will still occur in the ion exchange column dedicated to ammonia. Addition of breakpoint chlorination will improve the overall effectiveness of the ammonia treatment process so the final effluent will reliably meet permit ammonia effluent limits and water quality standards will not be exceeded.

Response 2.

This comment is outside the scope of comments listed in the public notice. However, Ecology recognizes that there is unintended ambiguity between the NPDES permit and the fact sheet. Later in 2009, Ecology will modify the NPDES permit to add the 3 additional outfalls where treated water will be discharged as established in the Settlement Agreement dated April 22, 2008, between and among Crown Resources Corporation, Okanogan Highlands Alliance, the Washington Environmental Council, and the Center for Environmental Law and Policy. At that time Outfall 2 will be clarified. Based on Ecology's inspections since October 2008, none of the discharges into Gold Bowl Creek have resulted in erosion or slope failure.

Response 3.

Effluent used for the spring 2008 and fall 2008 failed various aspects of the Whole Effluent Toxicity (WET) test requirements in the original NPDES permit. Crown reviewed the WET testing and opined that the results were not representative of actual operating conditions. Crown recommended that due to analytical and sampling problems and ongoing modifications to the treatment plant that the tests should be rerun. Ecology also reviewed the results of the WET tests and agreed. The WET testing schedule set in the original NPDES permit was intended to include effluent discharged during the high flow and low flow seasons of the year, as capturing the two end members of geochemical conditions. As a result of the uncertainty in the WET testing results and proposed changes in the treatment plant Ecology agreed to set aside the 2008 test results in favor of an additional round of seasonal testing in 2009. Due to the timing of bringing the breakpoint chlorination plant into operation, the spring 2009 sampling will not include effluent from that source. Ecology decided to keep the 2009 spring and fall sampling in the modified permit and add an additional spring and fall sampling in 2010. Those conditions are in the modified permit, Special Condition S.10.A and S.11.A. In that way, WET data will be obtained over the high flow and low flow seasons to include the updated treatment process, which was the objective of the original permit WET testing.

Response 4.

The Settlement Agreement dated April 22, 2008, between and among Crown Resources Corporation, Okanogan Highlands Alliance, the Washington Environmental Council, and the Center

for Environmental Law and Policy did not include Ecology. Ecology is following NPDES permit Condition S.3.D., which states:

D. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Condition S2. of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR.

For that reason, the modified permit only includes additional monitoring named in the Settlement Agreement that occurs at sites already named in NPDES permit Condition S.2.

Response 5.

This comment is outside the scope of comments listed in the public notice as there is no change in the detection limits for metals from the original NPDES permit.

Response 6.

There are no minor changes to the conditions in the NPDES permit.

Response 7.

As explained in Response 1 above, the AKART engineering report did consider ammonia treatment. The modified NPDES permit includes effluent limits for Total Residual Chlorine consistent with other permits issued by Ecology.

Response 8.

These comments are outside the scope of comments listed in the public notice and should be addressed to the Forest Service.