

**Memo**

To **Mr. Greg Missal**  
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cc

**Subject: Acute and Chronic Toxicity Protocols**

Effluent from the PKCA will be monitored at the last point of control prior to discharge into the receiving water. As discussed in SRK Consulting's Technical Memorandum W, the effluent will be sampled and tested for a comprehensive suite of chemical analyses on a weekly basis during the period of discharge from June through September. The results of the chemical analyses will be compared to the discharge criteria and will be the primary means of assessing whether the effluent can be safely discharged. However, periodic samples (monthly) will also be submitted for toxicity testing to ensure that the effluent is not acutely toxic to aquatic life.

Toxicity testing would be conducted in a staged, hierarchical format. The first stage will involve toxicity screening of the PKCA water using the Microtox® system. Should the results of the test prove negative (i.e. non-toxic), then discharge of the water can be continued without any concern for toxic effects in the receiving water. If however, the Microtox system indicates the presence of a toxic response, the following more intensive investigative actions could be taken.

- The lab conducting the toxicity test will confirm the toxicity with a second Microtox® test and determine the No-effect concentration (dilution) of PKCA water
- The lab will immediately conduct a 48-hr acute toxicity test using *Daphnia magna*. The results of this test will also be used to determine the toxicity and the no-effect dilution of the PKCA water.

If the 48-hr toxicity test using *Daphnia magna* fails to indicate a toxic response, discharge of the PKCA effluent to the receiving water would continue, but samples of the diluted effluent (taken from the mixing zone near the effluent discharge point) will be retested by the Microtox® system and a sample would also be submitted for chronic toxicity testing using the *Ceriodaphnia dubia* test for reproduction and survival to investigate any chronic toxic response within the mixing zone.

Should the 48-hr *Daphnia magna* acute toxicity test confirm the toxicity of the PKCA water as identified by the Microtox® system, the volume of the mixing zone would be used to re-assess the amount of effluent that can be safely be discharged using the no-effect concentrations derived from the previous toxicity tests. In addition, the results of the routine chemical analyses would be reviewed to identify potentially toxic components. Should the chemical analysis not reveal the probable cause of the acute toxicity, a formal Toxicity Identification Evaluation would



be initiated. This information would be integrated with the results of the chronic testing using *Ceriodaphnia dubia* described above.

Given the amount of information available at this point in the toxicity-testing format, the cause of the toxic responses should be apparent and artificial changes to samples of non-toxic PKCA water may be conducted for confirmation of the cause. There are a variety of laboratory toxicity tests available for determining the effects the discharged PKCA water on aquatic organisms (see references below). These tests are applicable for both end-of-pipe assessments as well as mixing zone assessments and could be utilized as needed to detail the effects, if any, of the PKCA discharges on the receiving water ecosystems.

Monitoring of faunal communities (either benthos or zooplankton) in the mixing zone or at the edge of the mixing zone would, in fact, be a test of the chronic or long-term effects of the introduced PKCA water in an in-situ fashion versus the formal, short-term, laboratory toxicity testing. Such tests would be covered through the Aquatics Effects Monitoring Plan outlined by Mainstream Aquatics.

Subtle changes in the mixing zone of the lake ecosystem receiving water are probable, but these changes will not effect the over-all ecological functioning of the lake. Truly adverse changes are very unlikely and will be detectable prior to their occurrence via the staged format of a toxicity-testing program.

Examples of References for Standardized Aquatic Toxicity Testing:

[Environment Canada 1990. Biological Test Method: Acute Lethality Test Using \*Daphnia\* spp., Report EPS 1/RM/11.](#)

[Environment Canada 1990 Acute Lethality Test Using Rainbow Trout. Report EPS 1/RM/9](#)

[Environment Canada 1992. Toxicity Test Using Luminescent Bacteria \(\*Photobacterium phosphoreum\*\) Report EPS 1/RM/24](#)

[Environment Canada 1992. Test of Reproduction and Survival using the Cladoceran \*Ceriodaphnia dubia\*\) Report EPS 1/RM/21.](#)

[Environment Canada 1992 Test of Larval Growth and survival Using Fathead Minnows Report EPS 1/RM/22](#)

[Environment Canada 1992 Toxicity Tests Using Early Life Stages of Salmonid Fish \(Rainbow Trout,,Coho Salmon, or Atlantic Salmon\). Report EPS 1/RM/28](#)