



Memorandum

Date: December 19, 2013

To: Patricia Randell, AAM, YG

Cc: Adrienne Turcotte, AAM, YG

From: Patti Orr, Minnow Environmental Inc.

RE: Toxicity Test Data Related to Elevated Zinc Concentrations in Rose Creek

The attached Table 1 presents a summary of toxicity test results reported by Nautilus Environmental via ALS. A preliminary review of the data indicates the following:

- Water collected at R10 and NF1, on the North Fork Rose Creek (NFRC) upstream from the Haul Road, was not toxic to any of the species tested;
- Water collected downstream from the Haul Road at NF2, X3A, and X1 was toxic to the invertebrate and plant species tested. Only the sample at NF2 was marginally acutely lethal to rainbow trout (i.e., 50% mortality within a 75-hour exposure period);

I am not certain of the location of X3A, but suspect it is on the Rose Creek Diversion (RCD), near the location where Arctic grayling have been observed to overwinter. I am not familiar with the location of the station named X1. If there are plans to circulate this memo, it would be helpful to attach a map depicting the sampling locations.

It is positive that the laboratory toxicity data verify lack of effects in the NF1 sample. This is the location where some Arctic grayling are known to be overwintering and most radio telemetry tags implanted on Arctic grayling in September continued to be detected by EDI as "active" as of December 10th. However, the laboratory toxicity data indicate there is potential for effects to aquatic biota in the NFRC downstream from the Haul Road. Unfortunately, it is not possible to use the laboratory results to estimate a specific magnitude of effects in the field. It is positive that all but the sample at NF2 were not acutely lethal to rainbow trout in laboratory tests and that two grayling continue to be detected as "active" in the RCD as of December 10th. No tags have registered in NFRC or RCD as "inactive, which might have been interpreted as potential mortality associated with the elevated zinc concentrations.

I assume that the reason that samples were not collected at stations downstream of the Haul Road for testing of rainbow trout embryo viability was because of the difficult logistics of collecting and shipping sufficient sample volume during winter. However, given the observed toxicity to other species associated with samples collected in the NFRC and RCD, we have a gap in our understanding of potential toxicity to fish in the same areas. Therefore, it is recommended that additional samples be collected from one or more areas in the NFRC and/or RCD for rainbow trout embryo viability. It is recommended that the rainbow trout acute lethality test, and the *Ceriodaphnia dubia* reproduction test also be repeated on the same sample(s) to provide some overlap with the first set of tests.

It would be helpful to see the chemistry data that presumably exist for these same samples.

Table 1: Summary of toxicity test results for surface water samples collected November 25, 2013, FMC.

Sample Location	Water Flea		Duckweed	Green Alga	Rainbow Trout	
	<i>Ceriodaphnia dubia</i> ^a		<i>Lemna minor</i> ^a	<i>P. subcapitata</i> ^b	<i>Oncorhynchus mykiss</i>	
	LC50 (%) ^d	IC25 (%) ^e	IC25 (%)	IC25 (%)	survival ^c	embryo viability ^a
					LT50 (hours) ^f	EC25 (%) ^g
R10	>100	>100	>97	>95.2	>96	- ^h
NF1	>100	>100	>97	>95.2	>96	>100
NF2	26.4	13.2	44.5	11.6	74.7	-
X3A	68.4	30.3	>97	20.0	>96	-
X1	36.6	25.1	87.2	24.0	>96	-

^a 7-day exposure

^b 72-hour exposure

^c 96-hour exposure

^d Concentration causing mortality to 50% of exposed population.

^e Concentration at which a 25% reduction in reproduction (*C. dubia*) or growth (*L. minor*, *P. subcapitata*) was observed.

^f Time to mortality of 50% of exposed organisms in full-strength sample.

^g Concentration causing effect on 25% of exposed population.

^h Not tested.