

Dog Creek. The field data indicates the monitoring approach is working (Weber Scannell and Ott, 2002)(Ott and Morris, 2005)

## V. Regulatory Background on Total Dissolved Solids

Total Dissolved Solids, regulated by the Department as Dissolved Inorganic Substances in 18 AAC 70.020(b)(4), means any mineral, salt, metal, cation or anion dissolved in water. TDS does not include suspended solids. The TDS in the wastewater discharge from the Red Dog Mine is regulated under national Pollution Discharge Elimination System (NPDES) permit AK-003865-2 issued by the U.S. Environmental Protection Agency (EPA) in August 1998. ADEC (2003) provides a history of the TDS limits in the permit.

In 18 AAC 70.235(c) the Department provides the opportunity for persons to petition for a site-specific criterion (SSC). TCAK requested a SSC in 2001 (Kulas, 2001). This request was for 1,500 mg/l TDS during the mine's seasonal discharge period except during Arctic grayling spawning (a period determined by the Alaska Department of Fish & Game) when the standard would be 500 mg/l. This petition was granted (ADEC, 2003). EPA requested additional testing on the effects of TDS on the spawning success of Arctic grayling in their approval of the SSC in 2003. Subsequently TCAK requested the 500 mg/l be raised to 1,500 mg/l and there be no specific period for Arctic Grayling spawning.

## VI. Summary of Public Comments

The Department held a public comment period from September 29, 2005 to November 2, 2005. On October 25, 2005 the Department held a public hearing. The hearing consisted of staff at the Anchorage and Kotzebue Legislative Information Offices and a statewide call in number. One person testified and five people listened. At the end of the comment period four people asked for the comment period to be extended thirty days. The Department granted an extension of fifteen days to November 17, 2005. See the responsiveness summary for a more detailed description of public comments and the Department's response. The following is a summary of the public comments received.

- A TDS level of 1,500 mg/l on the mainstem of Red Dog Creek does not adequately protect existing and designated uses on Ikalukrok Creek and the Wulik River.
- Determinations of simple total dissolved solids concentrations reveal nothing about the presence, absence, or specific concentrations of any metal sulfate compound in the discharge stream.
- The Brix and Grosell study does not yield any information about the possibility of long-term or delayed effects. For such responses to be monitored, a grow-out period is needed in addition to the fertilization tests.

- The report (Brix and Grosell) is unjustified in the exclusion of data as outliers. To exclude such data, if it was not really an aberrant test, will then lead to harming the fish populations if the TDS standards are relaxed.
- It is of great concern that DEC would propose to change the water quality standards for TDS based on such limited scientific information that has so many uncertainties and that has not been peer reviewed.

## **VII. Evidence Supporting Department Decision on Total Dissolved Solids Site-Specific Criterion**

According to 18 AAC 70.235(e) the applicant shall provide information that the Department determines is necessary to modify an existing criterion. Chapman et. al. (2000) reported that toxicity of TDS is affected by ionic composition of the mixture, the species tested, and the life history stage. Stekoll et. al. (2003) recommends that site-specific tests “may be the best method to use to set limits for TDS in issuing discharge permits.” Stekoll et. al. (2003) also specified that such tests should include short term bioassays at critical stages, such as fertilization or hatch. Stekoll et. al. (2003) also said the result of their study was relevant specifically to salmonids populations and that tests should be conducted on other species.

TCAK hired Ecotox Consultants in 2004 to conduct a study on the effects of TDS on Arctic grayling and Dolly Varden, the two species of concern in the Red Dog Creek/Ikalukrok Creek drainage not included in the Stekoll study. The study addressed the most critical lifestage – fertilization. The Department of Natural Resources, Office of Habitat Management and Permitting (OHMP), the Alaska Department of Fish & Game (ADF&G), EPA and the Department actively participated in discussions with TCAK during the development of the scope of work for the study.

The study was carried out at Red Dog Mine using water that mimicked the ionic composition of the receiving water (Brix and Grosell, 2005). OHMP assisted with the collection of adult Arctic grayling from Red Dog Creek and Dolly Varden from Ikalukrok Creek and the Wulik River that were used in the study (McLean, 2005). The study found the geometric mean of all test results resulted in a species mean value of 1,357 mg/l TDS for Arctic grayling and >1,779 mg/l TDS for Dolly Varden. A species mean value is the TDS concentration where effects below a certain threshold are not observed, in these studies the EC20 was the endpoint chosen for the threshold. The EC20 is the TDS concentration where effects were observed in 20 percent or less of the sample tested.

An inverse dose/ response relationship was observed in two of the Arctic grayling tests (AG 3 and 4) which may indicate that there were potential interferences due to the test methods or that the gametes used in the tests were not viable. Potential test method interference may have been due to increased ambient temperature during gamete collection or excessive holding times for the milt used in the fertilization tests. OHMP believes that the EC20s of 748 mg/l TDS and 202 mg/l TDS in Arctic grayling tests with the inverse dose response relationship (AG 3 and 4) may have been the result of using

gametes that were not viable (McLean, 2005). These gametes were collected from fish near the end of the spawning period. These values were given less weight when determining the TDS SSC for Arctic grayling of 1,500 mg/l. Less variability was observed in the 2005 Arctic grayling fertilization tests (AG 8-11) when researchers collected gametes during the height of the spawning period.

The Brix and Grosell report was reviewed by scientists with the EPA and OHMP. EPA believes "the weight of evidence demonstrates that 1,500 mg/l will protect salmonids during all life history phases in the main stem Red Dog Creek" (Brough, 2005). OHMP believes "that TDS concentrations at or below 1,500mg/l at Station 10 for the entire discharge season (i.e., open water) will provide for the proper protection of Arctic grayling in the Red Dog Creek drainage" (McLean, 2005).

Field studies to monitor the effect of the effluent from Red Dog Mine have been conducted since the mine opened. From 1999 to 2003 the ADF&G Habitat Division conducted aquatic biomonitoring in the creeks around Red Dog Mine as part of the NPDES permit monitoring. In 2004 OHMP (formerly ADF&G Habitat Division) took over the monitoring. The report for the 2004 field season (the most recently available data) states, "Arctic grayling use (adults and fry) of Mainstem Red Dog Creek currently is much higher than that described in baseline studies. Changes in use are likely related to overall improvements in water quality, increased primary production, and increased numbers and diversity of benthic invertebrates." (Ott and Morris, 2005) (p.80) This report provides field evidence that indicates that the Arctic grayling and invertebrates in Red Dog Creek are not being affected by the higher total dissolved solids levels.

### VIII. Conclusion

The Department has reviewed the information submitted by the applicant, researched other relevant available information, and considered issues raised by public comments.

As a result of its analysis of information described above and referenced in this document, the Department finds that the evidence:

1. *Reasonably demonstrates that the TDS SSC will fully protect the designated uses of this water body [ see 18 AAC 70.235(c)]:*

The designated uses of the main stem of Red Dog Creek are Industrial Water Supply, Contact and Secondary Recreation, and Growth and Propagation of Fish, Shellfish, Other Aquatic Life and Wildlife. Based on a review of the aquatic biomonitoring provided in Ott and Morris (2003) it appears that the current SSC of 1,500 mg/l during non-spawning periods of Arctic grayling is not injurious to the growth of Arctic grayling populations in the main stem Red Dog Creek. The results of Brix and Grosell (2005) indicate that an SSC of 1,500 mg/l will protect the propagation Arctic grayling in the main stem Red Dog Creek. During this period mid-May to mid-June other species of fish are lower down the river system in Ikalukrok Creek and would not be affected by the SSC. The monitoring

system TCAK installed and operates maintains a TDS concentration of 500 mg/l or less at Station 160 in Ikalukrok Creek.

2. *Reasonably demonstrates the existing SSC in 18 AAC 70.235(b)(5) is more stringent than necessary to ensure full protection of the designated uses of this water body [ see 18 AAC 70.235(c)(1)]; and*

The existing SSC during Arctic grayling spawning is 500 mg/l. The results of Brix and Grosell (2005) indicate that the SSC is more stringent than necessary to protect Arctic grayling spawning.

3. *Reasonably demonstrates that the species present, or expected to be present under natural conditions, are less sensitive to TDS than indicated in 18 AAC 70.235(b)(5) [see 18 AAC 70.235(d)(1)].*

The species expected to be present in the main stem of Red Dog Creek during the period Mid-May to Mid-June are Arctic grayling. Dolly Varden are downstream during this period of the year and tend to migrate upstream after break-up flows have subsided (Weber Scannell, 2003). ADF&G concludes that a TDS limit to ensure proper protection of chum salmon would also cover Dolly Varden spawning in terms of timing and location (ADEC, 2003). Prior to the studies by Brix and Grosell it was thought 500 mg/l was needed to be protective of Arctic grayling spawning (Weber Scannell, 2003). Based on the results of Brix and Grosell (2003) it is believed that 500 mg/l is not necessary to protect Arctic grayling spawning and that number could be raised to 1,500 mg/l.

The Department finds that the weight of evidence supports raising the TDS SSC during Arctic grayling spawning from 500 mg/l to 1,500 mg/l.

## IX. References

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Brough, S. 2005. Comments on Proposed Site-Specific Criterion for Total Dissolved Solids in main stem Red Dog Creek. Letter from S. Brough to W. Ashton November 1, 2005. U.S. Environmental Protection Agency, Seattle, WA. 2pp.

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