

LABORATORY AND FIELD TOXICITY TESTING OF BROWN TROUT EXPOSED TO ZINC¹

D.J. Hoff*, D. Wall, S. Brinkman²

Abstract: The historical mining district of California Gulch has drained into the Upper Arkansas River for over 100 years contaminating surface waters with heavy metals, primarily zinc. Several recent remedial actions have significantly reduced the loading of zinc however, additional clean-up activities may still be necessary. In an effort to determine safe concentrations of zinc for brown trout in the Upper Arkansas River, laboratory and field bioassays were conducted to help determine if additional remediation is necessary. Hardness-based dose-response curves were developed from the results of 7-Day continual flow dilution bioassays, and an acute-chronic ratio was applied to determine a protective value. Hazard quotients were then used to predict percent mortality of brown trout from the existing water quality data base from the site. During snow melt periods of the late spring months, mortality was predicted to be as high as 70% in 1996 and down to approximately 10% in 2005. Finally, zinc concentrations and hazard quotients were compared to field demographic endpoints to test the predictive power of bioassay-derived responses in estimating fish populations observed in the field. Sufficient alignment between the demographic data and the toxicity testing results were found to utilize the dose-response curves from the bioassays to determine a site-specific hardness-based equation for the protection of brown trout.

¹ Paper was presented at the 2006 Billings Land Reclamation Symposium, June 4-8, 2006, Billings MT and jointly published by BLRS and ASMR, R.I. Barnhisel (ed.) 3134 Montavesta Rd., Lexington, KY 40502.

² Dale Hoff, Toxicologist, EPA, Denver CO, 80202 (303) 312-6690. E-mail: hoff.dale@epa.gov; Dan Wall, Biologist, US Fish and Wildlife Service, c/o EPA, Denver CO, 80202 (303) 312-6560. E-mail: wall.dan@epa.gov; Stephan Brinkman, Colorado Division of Wildlife, Ft. Collins, Co. 80526 (970) 472 – 4332. E-mail: steve.brinkman@state.co.us