# Toxicity of Ammonia and Nitrite to Aquatic Macroinvertebrates

W. Tom Willingham, Dept. of Chemistry, Montana State University, Bozeman

Robert V. Thurston, Dept. of Chemistry, Montana State University, Bozeman

Robert J. Luedtke, U.S. Environmental Protection Agency, Office of Research and Development, Athens, GA

Rosemarie C. Russo. U.S. Environmental Protection Agency, Office of Research and Development, Athens, GA

The acute toxicity of ammonia was studied for six aquatic macroinvertebrate species (mayfly, stonefly, and caddisfly families). Two partial-chronic (24- and 30-day) tests were conducted on *Pteronarcella badia*. The acute toxicity of nitrite was studied for seven species, including one Diptera species; the mitigating effect of chloride ion on nitrite toxicity to two species was also investigated. For 6 tests on ammonia the median lethal concentration (96-hour LC50) values ranged from 1.8 to 5.0 mg/L un-ionized ammonia ($NH_3$); in 19 tests less than 50% of the larvae died at the highest test concentration, so an LC50 could not be calculated. In the partial-chronic tests on P. *badia*, food consumption was not affected at concentrations up to 6.9 mg/L $NH_3$, but concentrations in excess of 3.4 mg/L $NH_3$ adversely

affected nymphal survival rates and emergence of adults. For nitrite toxicity, test results showed a wide range of tolerance. The 96-hour LC50 for the single species of Diptera exceeded 123 mg/liter NO2-N; the 96-hour LC50 range for the other tests was between 0.25 and 2.4 mg/liter NO2-N. The addition of 10 mg/liter chloride ion in nitrite tests on P. *badia* and *Ephemerella grandis* resulted in a 3- to 10-fold decrease in 96-hour LC50 values. The tolerance to ammonia of the most sensitive of the insect species tested was greater than that reported in the literature for most species of fishes. Except for A. *variegata*, the range of acute toxicity of nitrite to the insects tested was similar to that reported for fishes.