Ecotoxicity Testing

IS IT TOXIC? No instrument has yet been devised that will measure toxicity! Chemical concentration can be measured with an instrument, with sensitive analytical equipment measuring chemical contaminants to parts per trillion levels. Toxicity can only be determined by measuring responses in living organisms. NIWA has been at the forefront of developing techniques to give meaningful measurements of toxicity under New Zealand conditions.

Toxicity measurements (i.e. determining adverse effects of environmental samples on test organisms or systems) and hazard assessment (i.e. linking measured toxicity levels with environmental exposure to contaminants) are becoming increasingly important areas of the environmental sciences. These techniques offer the tools required to assess the complex mixtures of chemical contaminants which occur in discharge, leachates and contaminated sediments.

Public interest and concern regarding toxic contaminants in the environment has grown in recent times in response to the dredging of harbour sediments, the widespread use of 1080 poison, and of herbicides for control of stream bank side and submerged species. Much of this public debate has been stimulated by the provisions of the Resource Management Act (1991). Present and future industrial development will be increasingly required to provide levels of effluent treatment which do not cause environmental harm.

Toxicity testing in New Zealand has been largely developed by NIWA since 1986. The ecological impacts of contaminants have also been increasingly studied in both marine and fresh waters. The general approaches are to use a suite of "standard" test species representing a range of phylogenic levels (e.g. microorganism, invertebrate, fish) for routine acute (short term) assessments.

In fresh water, NIWA's ecotoxicity studies have examined the sensitivity of a range of species.

Freshwater mussels (*Hyridella menziesi*) have been used to measure chemical contaminant levels and physiological response to geothermal and forest industry contaminants in the Waikato and Tarawera Rivers. Caged fingernail clams (*Sphaerium novaezelandiae*) were also used in the Tarawera River to provide sensitive sub lethal (growth and reproduction) measures of geothermal and pulp and paper mill effluent effects. Laboratory studies of mussel responses to differing levels of food and silt have been undertaken to assist interpretation of contaminant effects in conjunction with enrichment.

Biological toxicity testing studies have now been used by NIWA for quantitative assessment of the toxicity of a wide range of effluent types in New Zealand. The application of tiered assessment approach incorporating differing levels of testing complexity has provided a cost effective technique for establishing the environmental hazard of various effluent, leachates and contaminated sediments.

Although toxicity test results stand alone, they can be combined with either or both chemical contaminant analyses and measures of *in situ* biological effects. NIWA's comprehensive resources enable any combination of these methodologies to be applied, depending upon the complexity of the problem. ■

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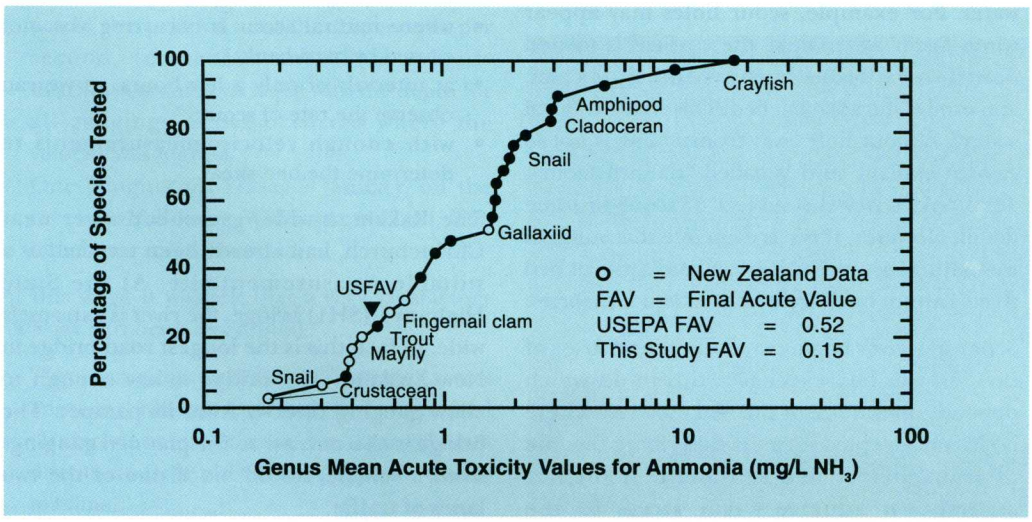
Note: Ecotoxicity Testing will be featured in more depth in the next issue of Water & Atmosphere.



Acute toxicity of ammonia (NH_3) to New Zealand native and international species.