

**The effect of true water
hardness and
alkalinity on the
toxicity of Cu and U to
two tropical Australian
freshwater organisms**



**N Riethmuller, S Markich,
D Parry and R van Dam**

Nadine Riethmuller – Environmental, Safety and Health, Energy Resources of Australia,
Locked Bag 1, Jabiru NT 0886, Australia.

Dr Scott Markich – Environment Division, Australian Nuclear Science and Technology
Organisation, Private Mail Bag 1, Menai NSW 2234, Australia.

Associate Professor David Parry – School of Biological, Environmental and Chemical Sciences,
Northern Territory University, Darwin 0909, Australia.

Dr Rick van Dam – Wetland Ecology & Conservation, Environmental Research Institute of the
Supervising Scientist, Locked Bag 2, Jabiru NT 0886, Australia.

This report should be cited as follows:

N Riethmuller, S Markich, D Parry & R van Dam 2000. *The effect of true water hardness and
alkalinity on the toxicity of Cu and U to two tropical Australian freshwater organisms.*
Supervising Scientist Report 155, Supervising Scientist, Canberra.

**The Supervising Scientist is part of Environment Australia, the environmental program of the
Commonwealth Department of Environment and Heritage.**

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Supervising Scientist
Environment Australia
GPO Box 461, Darwin NT 0801 Australia

ISSN 1325-1554

ISBN 0 642 24359 X

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Printed in Darwin by NTUniprint.

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Summary

The Australian and New Zealand water quality guidelines aim to supplement and modify existing criteria, which are mostly based on Northern Hemisphere toxicity data, with information relevant to Southern Hemisphere ecosystems as it becomes available. In the wet-dry tropics of Australia, copper (Cu) and uranium (U) are metals of particular concern, due to mining activities. Although the toxicity of Cu and U to tropical freshwater species has previously been characterised, the influence of physico-chemical parameters on toxicity has not been defined. In contrast, temperate freshwater studies have investigated the effects of various physico-chemical parameters on Cu toxicity and, to a limited extent, U toxicity. The reported results are, however, contradictory. Thus, it is recognised that the development of a model based on key water quality variables would enhance the capacity to predict the potential site-specific impacts of Cu and U in tropical ecosystems.

This research aimed to separate the effects of true water hardness (6.6, 165 and 330 mg L⁻¹ as CaCO₃) and alkalinity (4.0 and 102 mg CaCO₃ L⁻¹), at a constant pH (6.0), on the toxicity of Cu and U to *Hydra viridissima* (green hydra, population growth) and *Mogurnda mogurnda* (purple-spotted gudgeon, sac-fry survival). The effect of water hardness (ie Ca and Mg concentration) varied depending on the metal and test organism. A 50-fold increase in hardness resulted in a 2-fold decrease in the toxicity of Cu to *M. mogurnda*, but had no effect on U toxicity. The opposite was observed for *H. viridissima*, where increased hardness had no effect on Cu toxicity, but it decreased U toxicity by approximately 2-fold. A 25-fold increase in alkalinity (ie carbonate concentration) had no effect on Cu toxicity to *H. viridissima*, but decreased U toxicity by approximately 10%. Gaining a fundamental understanding of the interactions between physico-chemical parameters and metals, and the subsequent potential impacts on freshwater ecosystems is an essential aspect of site-specific environmental risk assessment and water quality guideline derivation.

Acknowledgments

We are very grateful to the Australian and New Zealand Environment and Conservation Council (ANZECC) for funding this work, and the Environmental Research Institute of the Supervising Scientist (*eriss*) for use of equipment and facilities. We thank Henri Wong and Atun Zawadski (ANSTO) for their assistance with chemical analysis. A special thanks is extended to Dr Ann Bull (*eriss*) for constructing the maps for this project. We are grateful to Professor Douglas Holdway (RMIT) and Dr Jenny Stauber (CSIRO) for providing constructive comments on the manuscript.