A COMPILATION OF DATA ON THE TOXICITY OF CHEMICALS TO SPECIES IN AUSTRALASIA. PART 4: METALS (2000-2009)

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Manuscript received, 10/12/2009; accepted, 4/3/2010.

ABSTRACT

This is the fourth paper in a series that presents data in the Australasian ecotoxicology database. The paper presents all the published and unpublished ecotoxicology data for metals that had been generated in Australasia since the initial publication of metal ecotoxicology data in 2002. The literature search identified 58 articles that contained relevant ecotoxicology data. In total, 1939 new metal ecotoxicology data were added to the database thus increasing the amount of such data by approximately 80%. A total of 521, 484, 185 and 749 data were added for freshwater, marine/estuarine, sediment and terrestrial environmental compartments, respectively. The additional toxicity data will substantially increase the relevance of future environmental quality guidelines or hazard and risk assessments to Australasian ecosystems.

Key words: metal; toxicity; database; Australasian species.

INTRODUCTION

Metals naturally occur in and are ubiquitous in the environment. From an ecotoxicological perspective metals can be divided into essential and non-essential metals. Essential metals are those that are required by at least some organisms for various life processes including enzymatic and metabolic reactions (Lehninger 1982). Essential metals include antimony (Sb), arsenic (As), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), nickel (Ni), tin (Sn), titanium (Ti), vanadium (V) and zinc (Zn) (Luoma and Rainbow 2008). Non-essential metals have no known biological function and these generally include cadmium (Cd), gold (Au), lead (Pb), mercury (Hg), palladium (Pd), platinum (Pt), silver (Ag) and uranium (U). The concentration response relationships of essential and non-essential metals are quite different, having 'U-shaped' and sigmoidal relationships, respectively. Toxic effects can be caused by essential metals concentrations being too low and causing deficiency-type effects and then being too high and causing toxicity. All metals, whether essential or non-essential to an organism, become toxic beyond certain threshold concentrations (Depledge et al. 1994). The issue of essentiality has not been properly addressed in ecotoxicology and in the derivation of environmental quality guidelines.

As metals occur naturally, they have natural biogeochemical cycles which involve the mobilisation of metals from rocks into soil and thence transport into waterways, biota and the atmosphere. This transport can be local, regional or global in nature. The dawn of the Industrial Revolution brought about an unprecedented increase in the use of metals in human health and welfare, the industrial economy and maintenance of national security (Nriagu 1994). Each year, large quantities of metal wastes are discharged into the environment so that for Pb, Cd, V and Zn, the human inputs are now far greater than the global natural sources by 28-, 6-, 3- and 8-fold, respectively (Nriagu 1990; Amiard and Amiard-Triquet 1993).

Major sources of anthropogenic metallic inputs into aquatic environments are domestic and industrial waste waters, sewage discharges, urban run-off and atmospheric fallout (Nriagu 1990). Furthermore, metal pollution in agroecosystems, primarily from the application of fertilisers and/or biosolids (i.e., treated sewage sludge) and increasingly from the application of industrial residues or by-products is of increasing environmental concern (Tiller et al. 2000). New guidelines for metal contaminants in biosolids, mineral fertilisers and industrial residues have recently been developed in Australia (Warne et al. 2007; Sorvari et al. 2009) with the aim of managing the potential environmental risks associated with metals in these materials.

Nearly a quarter of a century ago Hart (1986) reviewed the research priorities for water quality management and called for the establishment of a national ecotoxicology database. In 1996, work on the Australasian Ecotoxicology Database (AED) commenced. Its development was facilitated by the derivation of the 2000 ANZECC and ARMCANZ water quality guidelines for toxicants (ANZECC and ARMCANZ 2000). The aim of establishing the database was to have all toxicity data for native and introduced species that had been tested under Australasian conditions in one easily accessible location (see Warne et al. 1998). It was felt that this would facilitate the use of Australasian data in decision-making processes such as ecological hazard and risk assessments and could be used to guide research by indicating those chemicals or species for which more toxicity data are needed.

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The intent was that the AED would be available in two formats – publications in the *Australasian Journal of Ecotoxicology* and an electronic form (i.e., an ACCESS database). Toxicity data for pesticides, organic chemicals (excluding pesticides) and metals have been collated into the AED and published (Warne et al. 1998; Warne and Westbury 1999; and Markich et al. 2002, respectively). The current paper presents additional toxicity data for metals, including metalloids (As, Se) that have been generated and/or published since the previous metal AED publication (Markich et al. 2002). Having the database available electronically has never been achieved due to a lack of funds. However, this has been overcome by the current project. The whole AED will shortly be available on the CSIRO web-site (to locate it go to the CSIRO web-site http://www.csiro.au/ and then conduct a search for the Australasian Ecotoxicology Database).

The aims on this project were to: capture and synthesise the breadth of research undertaken in the field since the previous version of the AED; provide metal toxicity data for the forthcoming revision of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000); support life cycle assessment for metal and metal products in Australia; and ensure that the best-available science is publicly available to support transparent and scientifically rigorous policy development.

METHODS

An extensive literature review was conducted using Science Direct (http://www.sciencedirect.com/) and the ISI Web of Knowledge (http://apps.isiknowledge.com/UA_GeneralSearch_input.do?product=UA&search_mode=GeneralSearch&SID=4Alp8m@3@HaIeolIlLo&preferencesSaved=). In addition, scientists known to be conducting metal ecotoxicology research were directly contacted and asked to supply any published or unpublished data. The literature search identified approximately 300 articles which met the search key words (metal, toxicity, Australasia, Australia, New Zealand). This number was reduced to 58 articles which actually contained relevant ecotoxicology data. All journal articles as well as several project reports that contained metal toxicity data (including the metalloids As and Se) for native and introduced species tested under Australasian conditions that had been published since the previous publication of the AED for metals (Markich et al. 2002) or that were not included in the previous paper were collected.

Individual datum points were extracted from each of the papers/reports and entered into the database with a unique identifier number. Additional information that was entered along with each datum point included, the chemical being tested, the exposure regime (e.g., static, semi-static or flow-through), the test duration, the experimental conditions, the test species, the test species' characteristics (e.g., age, sex or length), the biological endpoint (e.g., lethality, reproductive impairment), the measure of toxicity (e.g., LC50, EC10, NOEC) and information on the statistics used. Toxicity data that were derived for mixtures of metals were not included in the database however they will be discussed in this report. Complex mixtures, for example, mine wastes, have not been included in the update of the database. Bioaccumulation data were also not included.

In the majority of studies, the toxicity data from each of the papers/reports were extracted and entered into the database in the form reported by the authors. In some studies not all possible measures of toxicity were calculated from the available data and therefore such data were analysed and the resulting toxicity values (e.g., NOEC, LOEC, EC50 or LC50 data) included in the AED. In some cases, the toxicity values were estimated from graphs provided in the publications/reports. Where this has been done it has been clearly recorded in the database in the section on how the toxicity data were calculated.

All the toxicity data were entered into the AED in the exact chemical form used (e.g., $CuSO_4.5H_20$) but have been presented in this paper as the individual metal (e.g., Cu). The valency state of the metals is presented when this information was presented in the articles/reports.

The quality of every toxicity datum point was determined and was entered into the database to indicate the robustness of the methods used to generate the data and therefore the reliability of the datum. The quality of each datum was determined using a marking scheme that varied slightly for aquatic (freshwater - having a salinity ≤ 2.5‰ and marine/estuarine – salinity > 2.5‰), sediment and terrestrial data (see Tables 1, 2 and 3, respectively). The total possible score that could be obtained for a datum point depended on the test medium used and organism type (e.g., the total possible score for aquatic organisms ranged from 88 to 100, Table 1), therefore, the quality was expressed as a percentage of the total possible score for that particular combination of test medium and organism type. Data points with quality scores of ≤ 50% were classed as unacceptable (U), 51 to 79% as acceptable (A) and ≥ 80% as of high (H) quality. Only data classed as H or A are deemed suitable for deriving trigger values (TVs) for toxicants in aquatic ecosystems in Australia and New Zealand (ANZECC and ARMCANZ 2000) and to derive proposed Australian contaminant guidelines for biosolids (Warne et al. 2007; Heemsbergen et al. 2009a) and ecological investigation levels for contaminated sites (Warne et al. 2009). When conducting hazard or ecological risk assessments similar scrutiny of the quality of the toxicity data is also required, but which quality classifications are suitable for a particular purpose will vary with each study.

RESULTS AND DISCUSSION

Summary statistics

All the toxicity data points that were entered into the AED as part of the current project are presented in Appendices A, B, C and D for freshwater, marine/estuarine, sediment and terrestrial data, respectively. A summary of all the data points entered in the AED for each of the environmental compartments (i.e., freshwater, marine/estuarine, sediment and terrestrial) as well as the total numbers are provided in Table 4. Overall, there were 1939 individual data points added to the AED that were obtained from 58 studies. In total,

Table 1. Marking scheme used to derive quality scores for aquatic toxicity data (freshwater and marine/estuarine) (from Hobbs et al. 2005).

Question		Mark
1.	Was the duration of the exposure stated (e.g., 48 or 96 hours)?	10 or 0
2.	Was the biological endpoint (e.g., immobilisation or population growth) stated and defined (10 marks)? Award 5 marks if the biological endpoint is only stated	10, 5 or 0
3.	Was the biological effect stated (e.g., LC or NOEC)?	5 or 0
4.	Was the biological effect quantified (e.g., 50% effect, 25% effect)?	5 or 0
	The effect for NOEC and LOEC data must be quantified.	
5.	Were appropriate controls (e.g., a no-toxicant control and/or solvent control) used?	5 or 0
6.	Was each control and chemical concentration at least duplicated?	5 or 0
7.	Were test acceptability criteria stated (e.g., mortality in controls must not exceed a certain percentage)	5, 2 or 0
	OR	
	were test acceptability criteria implied (e.g., test method used (USEPA, OECD, ASTM etc) uses validation criteria) (award 2 marks). Note: Invalid data must not be included in the database.	
8.	Were the characteristics of the test organism (e.g., length, mass, age) stated?	5 or 0
9.	Was the type of test medium used stated?	5 or 0
10.	Was the type of exposure (e.g., static, flow through) stated?	4 or 0
11.	Were the chemical concentrations measured?	4 or 0
12.	Were parallel reference toxicant toxicity tests conducted?	4 or 0
13.	Was there a concentration-response relationship either observable or stated?	4 or 0
14.	Was an appropriate statistical method or model used to determine the toxicity?	4 or 0
15.	For NOEC/LOEC/MDEC/MATC data was the significance level 0.05 or less?	4 or 0
	OR	
	For LC/EC/BEC data was an estimate of variability provided?	
16.	For metals tested in freshwater (FW), were the following parameters measured?	
	(i) pH,	3, 1 or 0
	(ii) hardness,	3, 1 or 0
	(iii) alkalinity and	3, 1 or 0
	(iv) organic carbon concentration	3, 1 or 0
	Award 3 marks for each variable that was measured during the test and values stated.	
	Award 1 mark for each parameter if it is measured but not stated or if they are measured and values are stated for the dilution water only.	
	OR	
	For all other chemicals, was the pH measured and values stated?	3, 1 or 0
	Award 1 mark if it is measured but not stated or if the pH of the dilution water only is measured and stated.	
17.	For marine and estuarine water (MEW), was the salinity/conductivity measured and stated?	3 or 0
18.	For tests not using aquatic macrophytes and alga, was the dissolved oxygen content of the test water measured during the test?	3 or 0
19.	Was the temperature measured and stated (3 marks)? Award 1 mark if only the temperature settings of the room or chamber are stated.	3, 1 or 0
20.	Were analytical reagent grade chemicals or the highest possible purity chemicals used for the experiment?	3 or 0
	Total score	
	Total possible score for the various types of data and chemicals:	
	FW/metal/non-plant = 100. FW/non-metal/non-plant = 91. FW/metal/plant = 97.	
	FW/non-metal/plant = 88. MEW/non-plant = 91. MEW/plant = 88)	
	Quality score ([Total score / Total possible score] * 100)	
	Quality class (H ≥ 80%, 51-79% A, U ≤ 50%)	

there were new data for 13 metals and for 87 test species that belonged to 14 divisions/phyla. The greatest number of data points added was for terrestrial toxicity where 749 data points were added to the database representing 31 different test species. The number of data points entered for freshwater and marine/estuarine was similar with 521 and 484 data points added, respectively. However, in terms of the total number of species tested within these two environmental compartments, there was over double the number of species tested in marine/estuarine systems than in freshwater and data for nearly 50% more divisions/phyla. There was a total of 185 sediment toxicity data points added into the AED. The AED previously did not contain any sediment toxicity data.

Overall, the quality of the data, as indicated by the quality score, was highly variable with values ranging from 37% for a terrestrial data point to 96% for a freshwater data point.

Table 2. Marking scheme used to derive quality scores for sediment toxicity data.

Question		Mark
1.	Was the duration of the exposure stated (e.g., 48 or 96 h)?	10 or 0
2.	Was the biological endpoint (e.g., immobilization or population growth) stated and defined (10 marks)? Award 5 marks if the biological endpoint is only stated	10, 5 or 0
3.	Was the biological effect stated (e.g., LC or NOEC)?	5 or 0
4.	Was the biological effect quantified (e.g., 50% effect, 25% effect)? The effect for NOEC and LOEC data must be quantified.	5 or 0
5.	Were appropriate controls (e.g., a no-toxicant control and/or solvent control) used?	5 or 0
6.	Was each control and contaminant concentration at least duplicated?	5 or 0
7.	Were test acceptability criteria stated (e.g., mortality in controls must not exceed a certain percentage) (5 marks)?	5, 2 or 0
	OR	
	Were test acceptability criteria implied (e.g., test method used [USEPA, OECD, ASTM etc]) (award 2 marks). Note: Invalid data must not be included in the database	
8.	Were the characteristics of the test organism (e.g., length, mass, age) stated?	5 or 0
9.	Was the type of test medium used stated?	5 or 0
10.	Was the type of exposure (e.g., static, flow through) stated?	4 or 0
11.	Were the contaminant concentrations measured?	4 or 0
12.	Were parallel reference toxicant toxicity tests conducted?	4 or 0
13.	Was there a concentration–response relationship either observable or stated	4 or 0
14.	Was an appropriate statistical method or model used to determine the toxicity?	4 or 0
15.	For LC/EC/BEC data values derived was an estimate of variability provided? (10/20 effects data desirable)	4 or 0
	OR	
	If NOEC/LOEC data, was the significance level 0.05 or less?	
16.	Were the following parameters measured and stated? (3 marks if measured and stated, 1 if just measured)	
	(i) pH	3, 1 or 0
	(ii) Particulate organic carbon (POC)	3, 1 or 0
	(iii) Particle size (e.g., <63 μm or silt/clay)	3, 1 or 0
	(iv) Acid-volatile sulfide (AVS) and 1-M HCl extractable metals	3, 1 or 0
	(v) Dissolved contaminants (e.g., metals) in porewater or overlying water	3, 1 or 0
	(vi) Dissolved ammonia and sulfide in porewater or overlying water	3, 1 or 0
17.	Was the temperature measured and stated?	3 or 0
18.	Was the grade or purity of the test contaminant stated?	3 or 0
19.	For marine and estuarine water (MEW), was the salinity/conductivity measured and stated?	3 or 0
20.	For freshwater sediment tests, was the alkalinity, hardness, or concentrations of Ca and Mg measured in the overlying water?	3 or 0
	Were known interacting elements on bioavailability measured (e.g., Cl for Cd)?	
21.	For sediments spiked with metal salts: were the equilibration conditions adequate?	3 or 0
	Total score	
	Total possible score for the various types of data and contaminants = 112	
	Quality score ([Total score / 112] * 100)	
	Quality class (H ≥ 80%, 51–79% A, U ≤ 50%)	

Although the range of quality score values was quite broad, the median quality scores did not vary markedly across the four environmental compartments. Data points which have quality scores < 50% are deemed unacceptable for deriving TVs in Australia and New Zealand (ANZECC and ARMCANZ 2000), therefore these data points would need to be removed from data sets prior to deriving TVs.

A summary of the composition of all the data points in the AED is presented in Table 5. It provides the total number of metals, species, divisions/phyla for which unique data are available, the number of studies from which data were sourced and the number of data points collated. In addition, it provides in parentheses the values for each parameter that were added in the current project. Thus, while the data in Table 4 indicate that freshwater toxicity data were entered for nine metals, only one of these was new to the AED (i.e., indicated by (1), Table 5). As sediment data had not previously been entered into the database, all the data were classed as new data, i.e., 13 new test species from four new divisions/phyla. As there is some overlap between the test species used in sediment tests with those used in marine/estuarine tests, each new species was only counted once to determine the total number of new species added to the database which was 41. Overall, the database currently has a total of 4346

Table 3. Marking scheme used to derive quality scores for terrestrial toxicity data (from Heemsbergen et al. 2009a).

Question		Mark
1.	Was the duration of the exposure stated (e.g., 48 or 96 h)?	10 or 0
2.	Was the biological endpoint (e.g., immobilization or population growth) stated and defined (10 marks)? Award 5 marks if the biological endpoint is only stated	10, 5 or 0
3.	Was the biological effect stated (e.g., LC or NOEC)?	5 or 0
4.	Was the biological effect quantified (e.g., 50% effect, 25% effect)? The effect for NOEC and LOEC data must be quantified.	5 or 0
5.	Were appropriate controls (e.g., a no-toxicant control and/or solvent control) used?	5 or 0
6.	Was each control and contaminant concentration at least duplicated?	5 or 0
7.	Were test acceptability criteria stated (e.g., mortality in controls must not exceed a certain percentage) (5 marks)? OR Were test acceptability criteria implied (e.g., test method used [USEPA, OECD, ASTM etc]) (award 2 marks). Note: Invalid data must not be included in the database	5, 2 or 0
8.	Were the characteristics of the test organism (e.g., length, mass, age) stated?	5 or 0
9.	Was the type of test medium used stated?	5 or 0
10.	Were the contaminant concentrations measured?	4 or 0
11.	Were parallel reference toxicant toxicity tests conducted?	4 or 0
12.	Was there a concentration–response relationship either observable or stated	4 or 0
13.	Was an appropriate statistical method or model used to determine the toxicity?	4 or 0
14.	For NOEC/LOEC data was the significance level 0.05 or less? OR For LC/EC/BEC data was an estimate of variability provided?	4 or 0
15.	Were the following parameters measured and stated? (3 marks if measured and stated, 1 if just measured)	
	(i) pH,	3, 1 or 0
	(ii) OM or OC content	3, 1 or 0
	(iii) Clay content	3, 1 or 0
	(iv) CEC	3, 1 or 0
16.	Was the temperature measured and stated?	3 or 0
17.	Was the grade or purity of the test contaminant stated?	3 or 0
18.	Were other cations and or major soil elements measured? OR Were known interacting elements on bioavailability measured (e.g., Mo for Cu and Cl for Cd)?	3 or 0
19.	For spiked soils with metal salts: Were the soils leached after spiking?	3 or 0
20.	Were the incubation conditions and duration stated?	3, 1 or 0
	Total score	
	Total possible score for the various types of data and contaminants: 102	
	Quality score ([Total score / 102] * 100)	
	Quality class (H ≥ 80%, 51–79% A, U ≤ 50%)	

Table 4. Summary of new metal toxicity data entered into the Australasian Ecotoxicology Database (AED) as presented in Appendices A, B, C and D.

Traits of the ecotoxicity data	Environmental compartment for which toxicity data are in the AED				
	Freshwater[a]	Marine/estuarine[b]	Sediment[c]	Terrestrial[d]	Total
Metals[e]	9	7	5	9	13
Species	17	38	13	31	87
Divisions/phyla	8	11	4	5	14
Studies	22	22	8	13	58
Data points	521	484	185	749	1939
Quality Score (%)	79	72	77	74	
[median (range)]	(64 – 96)	(39 – 85)	(44 – 82)	(37 – 91)	

[a] raw toxicity data presented in Appendix A; [b] raw toxicity data presented in Appendix B; [c] raw toxicity data presented in Appendix C; [d] raw toxicity data presented in Appendix D; [e] metals that have multiple oxidation states (As, Se and Cr) were treated as one metal.

Table 5. Summary of all metal toxicity data in the Australasian Ecotoxicology Database (AED), as presented in Appendices A, B, C and D and Markich et al. (2002). Values in parentheses are the number of new (in addition to that already in the AED) metals, species, divisions/phyla, and studies for which data were added to the AED in the current project and the totals.

	Freshwater	Marine/estuarine	Sediment	Soil	Total
Metals[a]	15 (1)	15(0)	5 (5)	16 (1)	22 (1)
Species	89 (4)	107 (19)	13 (13)	148 (17)	343 (41)
Divisions/phyla	12 (1)	13 (1)	4 (4)	5 (2)	19 (2)
Studies	94 (22)	96 (22)	8 (8)	77 (13)	263 (58)
Data points	1496 (521)	1120 (484)	185 (185)	1545 (749)	4346 (1939)

[a] metals that have multiple oxidation states (As, Se and Cr) were treated as one metal.

data points for 22 metals that has been extracted from 263 studies. Data are currently available for 343 test species from 19 divisions/phyla.

Metals studied and test species diversity

It is important to assess how comprehensive the data are in the AED. Tables 6, 7, 8 and 9 summarise this information for freshwater, marine/estuarine, sediment and terrestrial compartments, respectively. These tables present for each metal, the number of test species that belong to various divisions and/or phyla for which toxicity data are present in the AED. The numbers shown in parentheses indicate the number of species that belong to various divisions and/or phyla and were added during the present study.

Freshwater data

Table 6 shows the 15 individual metals for which there are freshwater toxicity data available in the AED (metals with multiple oxidation states have been shown separately, but were considered to be one metal). The current update included data on 9 of the 15 metals and also added data for one new metal (iron). There were only five metals, Cd, Cu, Fe, Pb and U for which there were toxicity data for new test species. There was the inclusion of data for one new freshwater division/phylum - cyanobacteria, but these data were only for Cu. In addition, over half of the freshwater data points that were updated into the AED were for copper (290 data points shown in Appendix A). Following Cu, the metals with the highest numbers of data points were Zn (85 data), Cd (61 data) and U (55 data). This summary of freshwater data provided in Table 6 indicates the need to increase test species diversity for toxicity testing on freshwater Australasian organisms, as well as the need to conduct toxicity testing on a broader range of metals. Based on the data shown in Table 6 there are sufficient acute toxicity data currently available in the AED to derive freshwater TVs for As(III), As(V), Cd, Cr(VI), Cu, U and Zn*.

Marine/estuarine data

Marine/estuarine toxicity data are available in the AED for a total of 14 metals (Table 7) (metals with multiple oxidation states have been shown separately, but were considered to be one metal). In the current update additional data were added for 7 of these 14 metals (Table 4). Toxicity data were added for new test species for six metals (Cd, Cu, Fe, Pb, Ni and Zn). The most diverse data set of these was for Cu where data on an additional 21 test species were added. The next most diverse was Zn where data for 15 new test species were added. This indicates that the toxicity of metals in the marine/estuarine compartment is being assessed for a more diverse range of marine/estuarine organisms than in the freshwater compartment. Similar to the freshwater data, only one new division/phylum was added in the marine/estuarine data (ie Dinoflagellata) which was again only for Cu. The majority of marine/estuarine toxicity data points added to the AED was again for Cu (304 data points, Appendix B). This was followed by Zn (109 data), Pb (28 data) and Cd (24 data). This indicates that although toxicity testing is being conducted on a broad range of Australasian marine/estuarine test species, a more extensive range of metals needs to be assessed. Based on the data summarised in Table 7, there are sufficient acute toxicity data available in the AED to derive marine/estuarine TVs for Cd, Cr(VI), Cu, Pb, Hg, Ni and Zn*.

Sediment data

The inclusion of sediment toxicity data added an additional environmental compartment for which Australasian toxicity were available in the database. All of the sediment data added were for marine sediments therefore there was considerable overlap of the test species used for the sediment and marine/estuarine data. Compared to the freshwater and marine/estuarine data sets, the sediment data were only available for a limited number of metals (i.e., Cd, Cu, Pb, Ni and Zn) with a limited number of test species (i.e., 13) from a limited number of divisions/phyla (i.e., 4) indicating that a greater understanding of metal toxicity to organisms in this test medium is required (Table 8). The majority of sediment toxicity data was again for Cu (102 data points added, Appendix C), followed by Zn (54 data). Even though the sediment toxicity data set is small in comparison to that available for the other environmental compartments, there are adequate acute toxicity data available for Cu to derive TVs*.

Terrestrial data

Terrestrial toxicity data are now available in the AED for a total of 16 metals (metals with multiple oxidation states have been shown separately, but were considered to be one metal) (Table 9). As part of the current update, terrestrial data were added for one new metal, selenium - as Se(IV) and (VI). Toxicity data were also added for two new divisions/

* i.e., data from a minimum of five species that belong to at least four taxonomic groups (ANZECC and ARMCANZ 2000; Warne 2001).

Table 6. The metals for which there are freshwater Australasian ecotoxicology data and a summary of the total number of species belonging to different divisions and/or phyla in the Australasian Ecotoxicology Database (AED) for each metal. Values in parentheses are the number of new species for which toxicity data were added to the AED in the current project (abstracted from Appendix A). The values in square brackets are the total number of species within each division/phylum.

Metal	Bacteria		Plants		Animals							
	Bacteria [4]	Cyano-bacteria [1]	Chlorophyta (green algae) [9]	Magnoliophyta (Angiosperms) [8]	Cnidaria [2]	Mollusca [7]	Annelida [1]	Chelicerata [1]	Crustacea [21]	Uniramia [7]	Chordata (fish) [27]	Chordata (amphibia) [1]
Aluminium	—	—	—	—	—	—	—	—	—	—	1	—
Arsenic (III)	—	—	3	—	—	1	1	—	3	3	—	—
Arsenic (V)	—	—	3	2	—	1	1	—	4	3	2	—
Cadmium	—	—	2 (1)	3	2	4	1	1	12	3	12	—
Chromium (VI)	2	—	2	1	—	—	—	—	7	1	2	—
Copper	2 (1)	1 (1)	8 (1)	4 (1)	2	5	—	1	11	2	17	1
Iron	—	—	—	—	—	—	—	—	1 (1)	—	—	—
Lanthanum	—	—	—	—	—	—	—	—	1	—	—	—
Lead	—	—	—	2	—	—	—	—	4 (1)	—	7	—
Manganese	—	—	—	—	—	1	—	—	—	—	2	—
Mercury	—	—	—	3	—	—	—	—	2	—	4	—
Nickel	—	—	—	2	—	—	—	—	3	—	2	—
Silver	—	—	—	2	—	—	—	—	—	—	—	—
Thallium	—	—	—	2	—	—	—	—	—	—	—	—
Uranium	—	—	2	1 (1)	2	1	—	—	4	—	10	—
Zinc	—	—	2	7	2	1	—	—	8	1	15	—

phyla for terrestrial organisms, bacteria and Pteridophyta. In the case of the bacteria, two new functional measures of toxicity, substrate-induced respiration and substrate-induced nitrification, were added for Cu and Zn, and data for substrate-induced nitrification were added for Pb. The phylum Pteridophyta includes fern species, for which toxicity data for ten different species were added for Cd, Cr(VI), Cu, Pb, Ni and Zn. For the remaining divisions/phyla presented in Table 9, new species were added for Cd, Cu, Pb, Se(IV), Se(VI) and Zn. The vast majority of the terrestrial toxicity data is for species belonging to Magnoliophyta and Pteridophyta, indicating that there is a need to obtain toxicity data on a broader range of terrestrial phyla. In terms of the total number of data added for individual metals, similar to the other environmental compartments (freshwater, marine/estuarine and sediment), there were the most data added for Cu (267 data points added, Appendix D) followed in order of decreasing number of data by Zn (196 data), aluminium (Al) (164 data) and Pb (38 data). Overall, in the AED, there are currently sufficient acute data to derive TVs for As (V), Cd, Cr(VI), Cu, Pb and Zn for the terrestrial environmen*. However, this is complicated by the fact that many of the terrestrial toxicity data available were not determined in soil but instead in aqueous media (e.g., hydroponically grown)

Acute and chronic toxicity data

Essentially all the metal toxicity data in the AED is acute, based on the definition of acute in the Australian and New Zealand WQGs (ANZECC and ARMCANZ 2000), apart from the data for micro-organisms, particularly unicellular algae, which are predominantly chronic. There is also a reasonable amount of early-life stage toxicity data which have sometimes been classified as sub-chronic and sometimes as acute. In the forthcoming revision of the Australian and New Zealand WQGs the definitions of acute, sub-chronic and chronic will need examining.

Currently the Australian and New Zealand WQGs give preference to the use of chronic toxicity data to derive TVs (ANZECC and ARMCANZ 2000; Warne 2001). There was also a stated preference to use data for as many species as possible irrespective of where the species occur. The reasoning was that when TVs are derived using the statistically-based species sensitivity

* i.e., data from a minimum of five species that belong to at least three taxonomic groups (Heemsbergen et al. 2009b; NEPC 2010).

Table 7. The metals for which there are marine/estuarine Australasian ecotoxicology data and a summary of the total number of species belonging to different divisions and/or phyla in the Australasian Ecotoxicology Database (AED) for each metal. Values in parentheses are the number of new species for which toxicity data were added to the AED in the current project (abstracted from Appendix B). The values in square brackets are the total number of species within each division/phylum.

Metal	Plants						Animals						
	Bacillariophyta (diatoms) [13]	Dinoflagellata [1]	Chlorophyta (green algae) [5]	Phaeophyta (brown algae [2]	Prymnesiophyta (golden-brown algae) [3]	Magnoliophyta (Angiosperms) [1]	Cnidaria [3]	Mollusca [17]	Annelida [7]	Crustacea [33]	Bryozoa [2]	Echinodermata [6]	Chordata (fish) [11]
Aluminium	—	—	—	—	—	—	—	1	—	—	—	1	—
Arsenic (III)	1	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic (V)	1	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	4	—	2	—	—	1	1 (1)	7	1	18	—	2	7
Chromium (VI)	2	—	3	2	1	—	—	2	—	5	—	1	2
Copper	12 (1)	1 (1)	6	1	3 (2)	—	7 (3)	13 (3)	6 (3)	22 (7)	2	5 (1)	4
Iron	—	—	—	—	—	—	—	2 (1)	—	1	—	1	—
Lead	1	—	—	—	—	—	3 (1)	2 (1)	1 (1)	3 (1)	—	2 (1)	2
Manganese	—	—	—	—	—	—	—	—	—	—	—	1	—
Mercury	—	—	2	—	—	1	—	1	3	4	2	1	3
Molybdenum	—	—	—	—	—	—	—	—	—	1	—	—	—
Nickel	1	—	—	—	—	—	1 (1)	—	—	4 (1)	—	1	2
Selenium (IV)	—	—	—	—	—	—	—	1	—	3	—	1	—
Selenium (VI)	—	—	—	—	—	—	—	—	—	1	—	1	—
Silver	—	—	—	—	—	—	—	—	—	—	—	1	—
Zinc	7	—	1	1	—	—	1 (1)	10 (4)	4 (2)	21 (7)	2	5 (1)	6

distribution methods (e.g., BurrliOZ, Campbell et al. 2000), it is best to use as many data as possible. Recent work on the relative sensitivities of species originating from different geographical locations indicates that this policy may need reconsideration. In addition, recent research (Schroer et al. 2004; Maltby et al. 2005; Van den Brink et al. 2006;) has shown that TVs derived using acute toxicity data are protective of species in mesocosms and field-based exposure. For example, Van den Brink et al. (2006) found that for nine herbicides the lower 95% confidence interval and median confidence interval (50%) values based on acute toxicity data resulted in values that were protective of micro- and mesocosms experiencing long-term exposure and a short-term or pulse exposure, respectively.

Toxicity of mixtures of metals

There were two studies that determined the toxicity of metal mixtures to Australasian freshwater organisms, and none for the other environmental compartments. The two studies assessed the toxic interactions of metal mixtures to two freshwater crustaceans (Cooper et al. 2009) and to the freshwater macrophyte *Lemna aequinoctialis* (duckweed) (Charles et al. 2006).

Cooper et al. (2009) used acute and chronic bioassays to observe the effect of binary and ternary mixtures of Cu, Pd and Zn to *Ceriodaphnia dubia* and *Daphnia carinata*. Interactions of the metal combinations mainly resulted in toxicity that conformed with concentration addition, however the toxicity was more than additive for three of the acute scenarios, i.e., both species exposed to Cu + Pb, *D. carinata* exposed to Cu + Zn and *C. dubia* exposed to all three metals (Cooper et al. 2009). In comparison, Charles et al. (2006) found the joint toxicity of Cu and U was less than additive using an equitoxic mixture to *L. aequinoctialis*.

Effects of physicochemical properties of the environmental compartment on speciation, bioavailability and toxicity

Metal speciation and hence bioavailability and toxicity in all four environmental compartments may be strongly influenced by a variety of physicochemical parameters of the environmental compartment of

Table 8. The metals for which there are sediment Australasian ecotoxicology data and a summary of the total number of species belonging to different divisions and/or phyla in the Australasian Ecotoxicology Database (AED) for each metal. Values in parentheses are the number of new species for which toxicity data were added to the AED in the current project (abstracted from Appendix C). The values in square brackets are the total number of species within each division/phylum.

Metal	Plants	Animals		
	Bacillariophyta (diatoms) [1]	Mollusca [3]	Annelida [3]	Crustacea [6]
Cadmium	—	—	—	1 (1)
Copper	1 (1)	3 (3)	3 (3)	6 (6)
Lead	—	—	—	1 (1)
Nickel	—	—	—	1 (1)
Zinc	—	3 (3)	2 (2)	5 (5)

Table 9. The metals for which there are terrestrial (soil or hydroponic) Australasian ecotoxicology data and a summary of the total number of species belonging to different divisions and/or phyla in the Australasian Ecotoxicology Database (AED) for each metal. Values in parentheses are the number of new species for which toxicity data were added to the AED in the current project (abstracted from Appendix D). The values in square brackets are the total number of species within each division/phylum.

Metal	Bacteria	Plants		Animals	
	Bacteria [2]	Magnoliophyta (angiosperms) [129]	Pteridophyta (ferns) [10]	Annelida [3]	Uniramia [4]
Aluminium	—	88	—	—	3
Arsenic(III)	—	1	—	—	3
Arsenic(V)	—	3	—	2	2
Cadmium	—	2	10 (10)	1	3 (1)
Cerium	—	4	—	—	—
Chromium(VI)	—	4	10 (10)	1	1
Cobalt	—	1	—	—	—
Copper	2 (2)	26 (8)	10 (10)	3 (1)	3
Gallium	—	1	—	—	—
Lanthanum	—	3	—	—	—
Lead	1 (1)	1	10 (10)	1	2 (1)
Manganese	—	38	—	—	—
Nickel	—	2	10 (10)	—	—
Scandium	—	1	—	—	—
Selenium (IV)		1 (1)			
Selenium(VI)	—	1 (1)	—	—	—
Thallium	—	2	—	—	—
Zinc	2 (2)	22 (9)	10 (10)	2 (1)	2 (1)

concern. For freshwater these include water hardness (primarily Ca and/or Mg concentration), alkalinity, pH, natural dissolved organic matter and redox potential (Stumm and Morgan 1996). The latter two parameters, in addition to salinity, are also relevant to marine and estuarine waters. In soils it has been known qualitatively, for quite some time, that bioavailability and toxicity are affected by a range of soil properties including soil pH, clay content, cation exchange capacity and organic carbon content (e.g., De Vries and Tiller 1978; Alloway 1995).

Although it was known that the above factors could affect bioavailability and toxicity of metals in freshwaters, there were only a few quantitative relationships between toxicity and water hardness that had been reported at the time of the release of the current Australian and New Zealand WQGs (ANZECC and ARMCANZ 2000). These quantitative relationships between metal toxicity and water hardness were developed for the Canadian and USA WQGs (Porter et al. 1995; USEPA 1995a, 1995b). There were insufficient data to derive water hardness – toxicity algorithms for Australian freshwater organisms (Markich et al. 2002) and therefore the North American algorithms were adopted into the Australian and New Zealand WQGs (ANZECC and ARMCANZ 2000; Markich et al. 2001). Markich and colleagues (Riethmuller et al. 2000; Riethmuller et al. 2001; Markich et al. 2005; Markich et al. 2006) in a series of articles argued that the North American algorithms had confounded true water hardness with alkalinity and/or pH. They then developed true water hardness – toxicity algorithms for Cu for a suite of Australian freshwater species (including a bacterium, a crustacean, a green alga, a hydra, a macroalga and a fish) (Riethmuller et al. 2001; Markich et al. 2005; Markich et al. 2006) and found that there was no significant change in toxicity with true water hardness and therefore using the algorithms in the Australian and New Zealand WQGs would not provide adequate protection to such organisms. They recommended that the hardness correction not be used for Cu and that biotic ligand models (BLMs) be used. No recommendations were made regarding the validity of the North American hardness algorithms for the other metals. Biotic ligand models have now been developed for a number of metals including As (e.g., Chen et al. 2009), Cu (e.g., Ryan et al. 2009), Ag (e.g., Niyogi and Wood 2004), Zn (e.g., Clifford and McGreer 2009) and Ni (e.g., Kozlova et al. 2009). Research developing BLMs in Australia has been extremely limited with only one publication (De Schamphelaere et al. 2005) on the toxicity of Cu to the green alga *Pseudokirchneriella subcapitata* (previously *Selenastrum capricornutum*) addressing this issue. Despite there being BLMs for a number of metals and species, adoption by regulators has been limited. Only the BLM for Cu has been adopted to derive WQGs (USEPA 2007) while BLMs for chronic toxicity are accepted for use by the European Chemical Bureau as part of Existing Substances legislation (Ahlf et al. 2009).

By 2002, when the previous publication on metal toxicity for the AED was published, there were no algorithms between physicochemical properties of marine/estuarine water and toxicity and between soil and toxicity. This situation, to the authors' knowledge, has not changed for the marine/estuarine compartment, but a number of such algorithms have been developed for the soil compartment. These include algorithms that explain the variation in toxicity of As, Cu, Zn and Ni to micro-organisms, plants and invertebrates (Rooney et al. 2006; Smolders et al. 2003; Smolders et al. 2004; Oorts et al. 2006; Broos et al. 2007; Song et al. 2006; Warne et al. 2008a; Warne et al. 2008b) and the uptake of Cd, Cu, Pb and Zn by plants (Nan et al. 2002; Li et al. 2003; McLaughlin et al. 2006). The Australian National Biosolids Research Program (NBRP) developed a number of these algorithms that could model the toxicity of Cu and Zn to selected soil microbial functions (Broos et al. 2007) and to wheat (both laboratory- and field-based) (Warne et al. 2008a; Warne et al. 2008b) as well as the uptake of Cd by wheat (McLaughlin et al. 2006). Many of these algorithms have been incorporated into recent environmental regulation and ecological risk assessments that include the European Union ecological risk assessments of existing chemicals (e.g., EC 2008a; EC 2008b; LDA 2008), the Flemish soil quality guidelines (VLAREBO 2008), the proposed Australian guidelines for Cd, Cu and Zn in biosolids (Warne et al. 2007; Heemsbergen et al. 2009b) and the proposed Australian ecological investigation levels for contaminated sites (Heemsbergen et al. 2009a; Warne et al. 2009). To date, there are no similar algorithms for organic chemicals in soils, although one would expect that soil pH and soil organic carbon content would be dominant soil physicochemical properties in such algorithms.

While the above algorithms have a sound mechanistic basis they are in fact empirical. Work has also been conducted on developing mechanistic models of toxicity in soils, in particular the free ion activity model (FIAM) and the terrestrial biotic ligand model (tBLM). The tBLM models have generally been found to provide better estimates of metal toxicity than the FIAM model (see following BLM references). Terrestrial BLMs have been developed for Cu and Ni to the collembolan *Folsomia candida* and the earthworm *Eisenia fetida* (Thakali et al. 2006b), Cu toxicity to the earthworm *Aporrectodea caliginosa* (Steenbergen et al. 2005), Zn toxicity to soil microbial nitrification (Mertens et al. 2007) and for Cu, Co and Ni to barley (*Hordeum vulgare*) (Thakali et al. 2006a; Lock et al. 2007; Antunes and Kraeger 2009). At this stage none of these has been adopted by regulators to derive SQGs, rather the empirical physicochemical property – toxicity algorithms are being adopted.

While sediment toxicity testing is a relatively new field, research has been conducted to establish if there are relationships between sediment physicochemical properties and toxicity. Unpublished work by Strom et al. (2008) has found that for Cu toxicity to an amphipod, *Melita plumulosa* and a bivalve, *Spisula trigonella,* the key factors are particle size (i.e., % silt) and the particulate organic carbon content (% POC).

A revision of the Australian and New Zealand WQGs commenced in July 2009 and there will need to be careful consideration of whether to incorporate the above developments into the methodology for deriving the WQGs.

Relative sensitivity of species from different geographical locations to toxicants

The current method for deriving WQGs in Australia and NZ (ANZECC and ARMCANZ 2000; Warne 2001) uses toxicity data irrespective of the geographical distribution of the test species. In doing this, it is assumed that species that occur in Australasia have the same sensitivity to toxicants as non-Australasian species. A number of publications have addressed this issue (e.g., Johnston et al. 1990; Sunderam et al. 1992; Davies et al. 1994; Mulhall 1997; Markich and Camilleri 1997; Rose et al. 1998; Hose and Van den Brink 2004; Westbury et al. 2004). However, the studies have always been too narrowly focussed in terms of chemicals and/or species to draw any general conclusions. In addition, the findings have often been contradictory with some finding differences and others finding no difference in sensitivity.

Similar concerns have also been raised elsewhere including Europe (Maltby et al. 2003), as well as in tropical (Leung et al. 2003; Kwok et al. 2007) and polar regions (Chapman and Riddle 2005; Chapman et al. 2006). All of these studies apart from Maltby et al. (2003), who compared North American and European species, found there were differences in the sensitivity of organisms from different geographical locations.

In particular, Kwok et al. (2007) compared the sensitivity of tropical and temperate marine species to a range of inorganic and organic chemicals and found that temperate data should be divided by an assessment factor of 10 in order to protect tropical species. Given the findings of Kwok et al. (2007) and Chapman et al. (2006), it is clear that organisms that occur in different geographical locations can have different sensitivities; this makes it pertinent to resolve the issue of whether Australasian and non-Australasian species have the same sensitivity to toxicants.

USING THE DATABASE

While every effort has been made to prevent errors in the database, it is possible that some will be present. It is therefore advisable that users refer to original data to ensure their correctness.

It would be appreciated that if authors of work cited in this report, or users of the database, find errors, they notify the principal author.

There is a considerable amount of toxicity testing being conducted but not being published that would be suitable for inclusion in the AED – for example consultancies determining site-specific trigger values or investigations of contaminated sites. We strongly encourage authors of such work to send a copy of the report to the principal author. Alternately, if there are any issues regarding confidentiality please only send the methods that are relevant to the toxicity testing and the results of the toxicity testing. Such data would go through the same process of data quality assessment as published data and would be included in the database and be attributed to the authors as unpublished data.

It is important that users realise that essentially all data presented are from laboratory studies and that there are difficulties in using such data to estimate effects in the field. This is due, amongst other reasons, to the effects of differences in chemical speciation, the presence of dissolved and suspended particulate matter, the selection of the test species and differences in chemical composition of test waters (Markich and Brown 1999) and the highly controlled experimental conditions and very simple test systems (e.g., testing one species in a test container containing only highly purified water) used in the laboratory.

FUTURE DEVELOPMENTS

An electronic version of the database will shortly be made available on the CSIRO web-site. This will be public domain and will permit any user to conduct searches for Australasian ecotoxicology data. The retrieved information will be exportable to either Word or Excel for further manipulation.

DISCLAIMER

This document has been prepared in good faith, exercising all due care and attention. No representational warranty, express or implied, is made as to the accuracy, completeness or fitness for purpose of this document in respect of any particular user's circumstances. Users of this document should satisfy themselves concerning its applicability to their use, and where necessary, refer to the original documents (where possible) cited in the database.

APPENDIX A

SUMMARY OF THE METAL TOXICITY DATA FOR AUSTRALASIAN FRESHWATER BIOTA.

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Aluminium	Chordata	purple spotted gudgeon (*Mogurnda mogurnda*)	<10 hrs old	semi-static	synthetic softwater	27	5					survival	96(h)	374 (LC50) (332-416) 547 (LC50) (524-570) 283 (MDEC) 130 (MDEC)	µgAl/L	m	78	Camilleri et al. (2003)
Arsenic (III)	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27±1			80-90	54		growth rate	72(h)	25.2 (IC50) (23.3-29.2)	mg/L	m	76	Levy et al. (2005)
		green algae (*Monoraphid-ium arcuatum*)	exponential growth phase	static	synthetic softwater	27±1			80-90	54		growth rate	72(h)	3.75 (LOEC)	mg/L	m	73	Levy et al. (2005)
		green algae (*Monoraphid-ium arcuatum*)	exponential growth phase	static	synthetic softwater	27±1			80-90	54		growth rate	72(h)	14.6 (IC50) (11.7-17.7)	mg/L	m	76	Levy et al. (2005)
Arsenic (V)	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27±1			80-90	54		growth rate	72(h)	1.93 (LOEC)	mg/L	m	73	Levy et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27±1			80-90	54		growth rate	72(h)	25.4 (IC50) (25.2-25.7)	mg/L	m	76	Levy et al. (2005)
		green algae (*Monoraphid-ium arcuatum*)	exponential growth phase	static	synthetic softwater	27±1			80-90	54		growth rate	72(h)	1.91 (LOEC) 0.081 (LOEC) 0.054 (LOEC)	mg/L	m	73	Levy et al. (2005)
		green algae (*Monoraphid-ium arcuatum*)	exponential growth phase	static	synthetic softwater	27±1			80-90	54		growth rate	72(h)	0.183 (IC50) (0.17-0.192) 0.254 (IC50) (0.253-0.255) 4.53 (IC50) (4.02-4.83)	mg/L	m	76	Levy et al. (2005)
Cadmium	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	48(h)	0.06 (NOEC) 0.19 (LOEC)	µmol/L	m	70	Franklin et al. (2002)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Cadmium	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	72(h)	<0.06 (NOEC) (0.81-1.5) 0.06 (LOEC) (0.81-1.5)	µmol/L	m	70	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	48(h)	0.85 (EC50) (0.81-1.5)	µmol/L	m	75	Franklin et al. (2002)
.	.	green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	72(h)	0.85 (EC50) (0.81-1.5)	µmol/L	m	75	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	72(h)	1 (EC50) (1-1.1) 1 (EC50) (0.99-1.1)	TU	m	75	Franklin et al. (2002)
Cadmium	Crustacea	cladoceran (*Moinodaphnia macleayi*)	adults, 2nd reproductive instar	semi-static	filtered water Magela Creek, NT	27±1						feeding rate	20(h)	0.5 (NOEC) 1.1 (LOEC) 1.2 (NOEC) 1.8 (LOEC)	µg/L	m	82	Orchard et al. (2002)
		cladoceran (*Moinodaphnia macleayi*)	adults, 2nd reproductive instar	semi-static	filtered water Magela Creek, NT	27±1						feeding rate	20(h)	9.6 (LC0) 11 (LC0) 0.8 (EC5) (0-1) 0.7 (EC5) (0.1-1.2) 5.9 (EC20) (0-7.5) 9 (EC20) >10.6 (EC50) >10 (EC50)	µg/L	m	87	Orchard et al. (2002)
		cladoceran (*Moinodaphnia macleayi*)	<6 days old	semi-static	filtered water Magela Creek, NT	27±1						feeding rate	5-6(d)	4.1 (EC50) (3-4.9)	µg/L	m	87	Orchard et al. (2002)
		cladoceran (*Moinodaphnia macleayi*)	<6 days old	semi-static	filtered water Magela Creek, NT	27±1						feeding rate	5-6(d)	1.7 (NOEC) 3.1 (LOEC) >10 (LC50)	µg/L	m	82	Orchard et al. (2002)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Cadmium	Crustacea	yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	21±1	8 ±0.5	88±2				mortality	24(h)	1692 (LC50) (1319-6570)	µg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	21±1	8 ±0.5	88±2				mortality	48(h)	913 (LC50) (790-1099)	µg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	21±1	8 ±0.5	88±2				mortality	72(h)	673 (LC50) (580-779)	µg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	21±1	8 ±0.5	88±2				mortality	96(h)	494 (LC50) (396-577)	µg/L	NR	77	Khan & Nugegoda (2007)
Cadmium	Mollusca	bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	6.5					duration valve opening	48(h)	104 (BEC10) 106 (BEC10) 104 (BEC10) 115 (MDEC) 112 (MDEC) 111 (MDEC) 182 (EC50) (172-192) 176 (EC50) (167-185) 179 (EC50) (170-188)	µg/L	m	79	Markich et al. (2003)
		bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	6.8					duration valve opening	48(h)	98 (BEC10) 104 (MDEC) 174 (EC50) (164-184	µg/L	m	79	Markich et al. (2003)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Cadmium	Mollusca	bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	7					duration valve opening	48(h)	108 (BEC10) 98 (BEC10) 101 (BEC10) 107 (MDEC) 104 (MDEC) 118 (MDEC) 175 (EC50) (166-184) 181 (EC50) (172-190) 167 (EC50) (158-176)	µg/L	m	79	Markich et al. (2003)
		bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	7.3					duration valve opening	48(h)	96 (BEC10) 102 (MDEC) 170 (EC50) (160-180)	µg/L	m	79	Markich et al. (2003)
		bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	7.5					duration valve opening	48(h)	106 (BEC10) 103 (BEC10) 98 (BEC10) 104 (MDEC) 110 (MDEC) 115 (MDEC)	µg/L	m	79	Markich et al. (2003)
		bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	7.5					duration valve opening	48(h)	184 (EC50) (174-194) 180 (EC50) (170-190) 169 (EC50) (160-178)	µg/L	m	79	Markich et al. (2003)
Copper	Bacteria	bacteria (*Erwinia* sp.)	24-h old culture	static	synthetic freshwater	30	5.5		40			assimilation of 14C-glucose	4(h)	0.7 (EC50) (0.6-0.7)	µg/L	m	66	Rogers et al. (2005)
		bacteria (*Erwinia* sp.)	24-h old culture	static	synthetic freshwater	30	6.5		40			assimilation of 14C-glucose	4(h)	2.5 (EC50) (2.3-2.6)	µg/L	m	66	Rogers et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Bacteria	bacteria (*Erwinia* sp.)	24-h old culture	static	synthetic freshwater	30	6.5		120			assimilation of 14C-glucose	4(h)	3.4 (EC50) (0.9-4.8)	µg/L	m	66	Rogers et al. (2005)
		bacteria (*Erwinia* sp.)	24-h old culture	static	synthetic freshwater	30	6.5		400			assimilation of 14C-glucose	4(h)	5.6 (EC50) (1.1-7.2)	µg/L	m	66	Rogers et al. (2005)
		bacteria (*Erwinia* sp.)	24-h old culture	static	synthetic freshwater	30	7.5		40			assimilation of 14C-glucose	4(h)	0.6 (EC50) (0.4-1)	µg/L	m	66	Rogers et al. (2005)
		bacteria (*Erwinia* sp.)	24-h old culture	static	riverine water from NSW	30						assimilation of 14C-glucose	4(h)	3.4 - 34.0 (EC50)	µg/L	m	66	Rogers et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	natural freshwater from Paddy's Creek NSW	30	6.1		25			assimilation of 14C-glucose	4(h)	8 (IC50) (6-9)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	natural freshwater from Paddy's Creek NSW	30	6.1		140			assimilation of 14C-glucose	4(h)	8 (IC50) (5-10)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	natural freshwater from Paddy's Creek NSW	30	6.1		375			assimilation of 14C-glucose	4(h)	13 (IC50) (9-14)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	natural freshwater from Paddy's Creek NSW	30	7		25			assimilation of 14C-glucose	4(h)	11 (IC50) (8-16)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	natural freshwater from Paddy's Creek NSW	30	7		140			assimilation of 14C-glucose	4(h)	11 (IC50) (10-11)	µg Cu/L	m	64	Markich et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Bacteria	bacteria (*Erwinia* sp.)	NR	static	natural freshwater from Paddy's Creek NSW	30	7		375			assimilation of 14C-glucose	4(h)	11 (IC50) (10-13)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	natural freshwater from Paddy's Creek NSW	30	7.8		25			assimilation of 14C-glucose	4(h)	13 (IC50) (12-13)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	natural freshwater from Paddy's Creek NSW	30	7.8		140			assimilation of 14C-glucose	4(h)	10 (IC50) (9-10)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	natural freshwater from Paddy's Creek NSW	30	7.8		375			assimilation of 14C-glucose	4(h)	10 (IC50) (9-10)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	synthetic freshwater	30			44			assimilation of 14C-glucose	4(h)	2.5 (IC50) (2.3-2.8)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	synthetic freshwater	30			125			assimilation of 14C-glucose	4(h)	3.4 (IC50) (0.9-4.5)	µg Cu/L	m	64	Markich et al. (2005)
		bacteria (*Erwinia* sp.)	NR	static	synthetic freshwater	30			374			assimilation of 14C-glucose	4(h)	5.6 (IC50) (2.1-7.3)	µg Cu/L	m	64	Markich et al. (2005)
Copper	Cyano-bacteria	blue-green algae (*Microcystis aeruginosa*)	exponential growth phase	static	synthetic softwater	21			40-48	30-35		growth rate	48(h)	<0.75 (IC50) <0.75 (IC50)	µg/L	m	70	Franklin et al. (2004)
		blue-green algae (*Microcystis aeruginosa*)	exponential growth phase	static	synthetic softwater	21			40-48	30-35		growth rate	72(h)	<0.75 (IC50) <0.75 (IC50)	µg/L	m	70	Franklin et al. (2004)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conductivity (µS/cm)	Hardness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Chlorophyta	euglenoid (*Trachelomonas* sp.)	exponential growth phase	static	synthetic softwater	21			40-48	30-35		growth rate	48(h)	2.7 (IC50) (2.3-3.4) 5.1 (IC50) (4.7-5.6)	µg/L	m	70	Franklin et al. (2004)
		euglenoid (*Trachelomonas* sp.)	exponential growth phase	static	synthetic softwater	21			40-48	30-35		growth rate	72(h)	2.8 (IC50) (2.1-3.6) 9.8 (IC50) (7.1-14)	µg/L	m	70	Franklin et al. (2004)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	24						growth rate	48(h)	28.9 (EC50) (26.7-31.7) 1 (EC10) (0.7-1.6) 16 (EC10) (13.3-19.4) 7.1 (EC50) (5.8-8.7)	fg/cell	m	70	De Schamphelaere et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	24	7.5 ±0.2		15	9		growth rate	72(h)	4.7 (NOEC) 1.1 (NOEC) 2.4 (NOEC) 9 (NOEC) 2 (LOEC) 3.3 (LOEC) 12 (LOEC) 6 (LOEC)	µg/L	m	73	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	24	7.5 ±0.2		15	9		growth rate	72(h)	7.3 (LOEC) (6.7-8) 4.6 (EC50) (3.5-6) 4.4 (EC50) (3.9-5) 16 (EC50) (14-18)	µg/L	m	78	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	48(h)	0.05 (NOEC) 0.07 (LOEC)	µmol/L	m	70	Franklin et al. (2002)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	48(h)	0.09 (EC50) (0.08-0.11)	µmol/L	m	75	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	72(h)	0.07 (NOEC) 0.09 (LOEC)	µmol/L	m	70	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	72(h)	0.11 (EC50) (0.11-0.13)	µmol/L	m	75	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	72(h)	0.95 (EC50) (0.92-1)	TU	m	75	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	JM/5 medium	27±1						growth	72(h)	4.3 (NOEC) 3.4 (NOEC) 4.1 (NOEC) 4.3 (NOEC) 5.1 (NOEC)	µg/L	m	68	Johnson et al. (2007)
		green algae (*Chlorella* sp.)	exponential growth phase	static	JM/5 medium	27±1						growth	72(h)	8.8 (NOEC) 8.7 (LOEC) 7.8 (LOEC) 7.4 (LOEC) 12.4 (LOEC) 8.7 (LOEC) 6.7 (LOEC)	µg/L	m	68	Johnson et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	JM/5 medium	27±1						growth	72(h)	2.5 (IC10) (0.7-6.6)	µg/L	m	72	Johnson et al. (2007)
														9.1 (IC10) (0-9.6)				
														4.7 (IC10)				
														4.6 (IC10) (4-4.9)				
														5 (IC10)				
														4 (IC10) (3.3-11.9)				
														4.7 (IC10) (4.4-5.7)				
														5.4 (IC25) (4.8-5.9)				
														6.2 (IC25)				
														5.2 (IC25) (3.6-11.9)				
														5.6 (IC25)				
														9.8 (IC25) (9-10.7)				
														5 (IC25) (4-6)				
														5.6 (IC25) (4.9-7.2)				
														11.1 (IC50) (10.3-12.6)				
														7.3 (IC50)				
														6.8 (IC50) (5.8-8)				
														7.4 (IC50) (5.7-9.2)				
														7.9 (IC50)				
														6.8 (IC50) (6.2-7.7)				
														7.2 (IC50) (4-11.7)				

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	very softwater	27	5.7		2-4			growth rate	72(h)	4 (NOEC) 26 (NOEC) 5 (LOEC) 55 (LOEC)	µg Cu/L	m	69	Levy et al. (2009)
		green algae (*Chlorella* sp.)	exponential growth phase	static	very softwater	27	5.7		2-4			growth rate	72(h)	208 (EC50) (114-289) 46 (EC50) (36-57)	µg Cu/L	m	74	Levy et al. (2009)
		green algae (*Chlorella* sp.)	exponential growth phase	static	very softwater	27	6.5		2-4			growth rate	72(h)	<1 (NOEC) <1 (NOEC) 1 (LOEC) 1 (LOEC)	µg Cu/L	m	69	Levy et al. (2009)
		green algae (*Chlorella* sp.)	exponential growth phase	static	very softwater	27	6.5		2-4			growth rate	72(h)	19 (EC50) (0-43) 28 (EC50) (27-28)	µg Cu/L	m	74	Levy et al. (2009)
		green algae (*Chlorella* sp.)	exponential growth phase	static	softwater	27	7.4-7.5		80-90			growth rate	72(h)	2.3 (NOEC) 2.3 (NOEC) 2.8 (LOEC) 3 (LOEC)	µg Cu/L	m	69	Levy et al. (2009)
		green algae (*Chlorella* sp.)	exponential growth phase	static	softwater	27	7.4-7.5		80-90			growth rate	72(h)	3.1 (EC50) (3-3.2) 3 (EC50) (2.9-3)	µg Cu/L	m	74	Levy et al. (2009)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		6.1		25			cell division	48(h)	48 (IC50) (40-45)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		6.1		140			cell division	48(h)	30 (IC50) (26-32)	µg Cu/L	m	86	Markich et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		6.1		375			cell division	48(h)	16 (IC50) (14-18)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		6.5		25			cell division	48(h)	42 (IC50) (38-44)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		6.5		140			cell division	48(h)	19 (IC50) (16-23)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		6.5		375			cell division	48(h)	25 (IC50) (22-27)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		7		25			cell division	48(h)	46 (IC50) (42-49)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		7		140			cell division	48(h)	38 (IC50) (36-40)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		7		375			cell division	48(h)	45 (IC50) (43-48)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		7.8		25			cell division	48(h)	11 (IC50) (11-12)	µg Cu/L	m	86	Markich et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		7.8		140			cell division	48(h)	14 (IC50) (12-17)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	natural freshwater from Paddy's Creek NSW		7.8		375			cell division	48(h)	12 (IC50) (11-12)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater				44			cell division	48(h)	4.5 (IC50) (1.8-6.6)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater				125			cell division	48(h)	3.4 (IC50) (3-5.2)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater				374			cell division	48(h)	3.4 (IC50) (2.8-4)	µg Cu/L	m	86	Markich et al. (2005)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	5.5	160	40-48			growth	48(h)	2.6 (MDEC) 19 (IC50) (16-22)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	6	160	40-48			growth	48(h)	2.2 (MDEC) 7.1 (IC50) (6.1-8.1)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	6.5	160	40-48			growth	48(h)	1.2 (MDEC) 2.7 (IC50) (2.3-3.1)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	7	160	40-48			growth	48(h)	0.8 (MDEC) 1.7 (IC50) (1.5-1.9)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	7.5	160	40-48			growth	48(h)	0.4 (MDEC) 1.1 (IC50) (1-1.2)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	8	160	40-48			growth	48(h)	0.5 (MDEC) 1 (IC50) (0.9-1.1)	µg/L	m	86	Wilde et al. (2006)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Chloro-phyta	green algae (*Pseudokirch-neriella subcapitata*)	exponential growth phase	static	US EPA standard medium without EDTA	21	7.4-7.5		80-90			growth rate	72(h)	0.3 (NOEC) >0.8 (NOEC) 0.6 (LOEC) >0.8 (LOEC)	µg Cu/L	m	69	Levy et al. (2009)
		green algae (*Pseudokirch-neriella subcapitata*)	exponential growth phase	static	US EPA standard medium without EDTA	21	7.4-7.5		80-90			growth rate	72(h)	0.8 (EC50) (0.8-0.9) 0.8 (EC50) (0.5-1.1)	µg Cu/L	m	74	Levy et al. (2009)
		green algae (*Pseudokirch-neriella subcapitata*)	exponential growth phase	static	synthetic softwater	21			40-48	30-35		growth rate	48(h)	4.2 (IC50) (3.1-5.6) 5.1 (IC50) (3.9-6.8)	µg/L	m	70	Franklin et al. (2004)
		green algae (*Pseudokirch-neriella subcapitata*)	exponential growth phase	static	synthetic softwater	21			40-48	30-35		growth rate	72(h)	4.7 (IC50) (3.8-5.8) 4.6 (IC50) (3.8-5.6)	µg/L	m	70	Franklin et al. (2004)
		green algae (*Pseudokirch-neriella subcapitata*)	exponential growth phase	static	US EPA standard medium without EDTA	24	7.5 ±0.2		15	9		growth rate	72(h)	4.6 (NOEC) 1.8 (NOEC) 1.9 (NOEC) 3.4 (NOEC) 3.2 (LOEC) 4.8 (LOEC) 6.6 (LOEC) 3.8 (LOEC)	µg/L	m	73	Franklin et al. (2002)
		green algae (*Pseudokirch-neriella subcapitata*)	exponential growth phase	static	US EPA standard medium without EDTA	24	7.5 ±0.2		15	9		growth rate	72(h)	17 (EC50) (14-20) 7.5 (EC50) (6.8-8.2) 6.2 (EC50) (5.5-6.9) 6.6 (EC50) (5.9-7.3)	µg/L	m	78	Franklin et al. (2002)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Chloro-phyta	green algae (*Pseudokirch-neriella subcapitata*)	exponential growth phase	static	OECD test water without EDTA	25±1						growth rate	48(h)	16.9 (EC10) (11.7-24.3) 2.7 (EC10) (1.5-4.7) 52.9 (EC50) (46-61.5) 15.6 (EC50) (12-20.3)	fg/cell	m	70	De Schamphe-laere et al. (2005)
Copper	Magnolio-phyta	duckweed (*Lemna aequinoctialis*)	12 fronds	semi-static	synthetic freshwater	27±1	6.5 ±0.2					growth	96(h)	3.2 (MDEC) 16.2 (EC50) (15.5-16.9)	µg/L	m	89	Charles et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		35			biomass	96(h)	4.6 (MDEC) 8.4 (EC50) (7.6-9.2)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		35			carotenoids	96(h)	14 (MDEC) 36 (EC50) (33-38)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		35			stem length	96(h)	5.4 (MDEC) 9.8 (EC50) (8.9-11)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		35			total chl	96(h)	9.3 (MDEC) 28 (EC50) (26-31)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		90			biomass	96(h)	5.3 (MDEC) 8.9 (EC50) (8-9.8)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		90			carotenoids	96(h)	15 (MDEC) 37 (EC50) (35-40)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		90			stem length	96(h)	5.3 (MDEC) 10 (EC50) (9.1-11)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		90			total chl	96(h)	9.9 (MDEC) 31 (EC50) (28-33)	µg/L	m	93	Markich et al. (2006)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Magnolio -phyta	rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		335			biomass	96(h)	5.1 (MDEC) 9.9 (EC50) (9-11)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		335			carotenoids	96(h)	17 (MDEC) 39 (EC50) (37-41)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		335			stem length	96(h)	5.6 (MDEC) 11 (EC50) (10-12)	µg/L	m	93	Markich et al. (2006)
		rigid hornwort (*Ceratophyllum demersum*)	10 days old, 5 leaf whorls	semi-static	synthetic freshwater	27±1	7.0 ±0.2		335			total chl	96(h)	10.8 (MDEC) 31 (EC50) (29-34)	µg/L	m	93	Markich et al. (2006)
Copper	Crustacea	cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	natural creek water	25±1	6	160-180	25	13		immobilis-ation	48(h)	11 (EC50) (10-12)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	natural creek water	25±1	7	160-180	25	13		immobilis-ation	48(h)	23 (EC50) (21-25)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	natural creek water	25±1	7.8	160-180	25	13		immobilis-ation	48(h)	42 (EC50) (39-45)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	natural creek water	25±1	7	160-180	44	30		immobilis-ation	48(h)	55 (EC50) 13 (EC50) 35 (EC50) 18 (EC50) 37 (EC50) 48 (EC50) 68 (EC50) 85 (EC50) 98 (EC50) 60 (EC50)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	natural creek water	25±1	7	160-180	140	13		immobilis-ation	48(h)	32 (EC50) (29-34)	µg/L	m	90	Hyne et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Crustacea	cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	natural creek water	25±1	7	160-180	374	13		immobilis-ation	48(h)	30 (EC50) (27-32)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	6.5	160-180	44	30		immobilis-ation	48(h)	9.5 (EC50) 41 (EC50) 1.6 (EC50) (1.8-2.3)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	7.5	160-180	44	30		immobilis-ation	48(h)	2.8 (EC50) (2.5-3.1)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	8.1	160-180	44	60		immobilis-ation	48(h)	6.5 (EC50) (7.1-5.9)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	8.4	160-180	44	125		immobilis-ation	48(h)	16 (EC50) (14-17)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	6.5	160-180	44	30		immobilis-ation	48(h)	73 (EC50) (67-78)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	7.5	160-180	44	30		immobilis-ation	48(h)	2.2 (EC50) (2-2.5)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	6.5	160-180	44	30		immobilis-ation	48(h)	1.6 (EC50) (1.4-1.7)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	5.5	160-180	44	30		immobilis-ation	48(h)	1.6 (EC50) (1.3-1.9)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	synthetic freshwater	25±1			44			immobilis-ation	48(h)	1.6 (IC50) (1.4-1.7)	µg Cu/L	m	83	Markich et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	synthetic freshwater	25±1			374			immobilis-ation	48(h)	1.6 (IC50) (1.4-1.7)	µg Cu/L	m	83	Markich et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Crustacea	cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	natural freshwater from Paddy's Creek NSW	25±1	6.1		25			immobilis-ation	48(h)	11 (IC50) (10-12)	µg Cu/L	m	83	Markich et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	<24-h old neonates	static	natural freshwater from Paddy's Creek NSW	25±1	6.1		140			immobilis-ation	48(h)	12 (IC50) (11-13)	µg Cu/L	m	83	Markich et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	natural freshwater from Paddy's Creek NSW	25±1	6.1		375			immobilis-ation	48(h)	9 (IC50) (4-14)	µg Cu/L	m	83	Markich et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	natural freshwater from Paddy's Creek NSW	25±1	7		25			immobilis-ation	48(h)	23 (IC50) (21-25)	µg Cu/L	m	83	Markich et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	natural freshwater from Paddy's Creek NSW	25±1	7		140			immobilis-ation	48(h)	32 (IC50) (29-34)	µg Cu/L	m	83	Markich et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	natural freshwater from Paddy's Creek NSW	25±1	7		375			immobilis-ation	48(h)	30 (IC50) (27-32)	µg Cu/L	m	83	Markich et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	natural freshwater from Paddy's Creek NSW	25±1	7.8		25			immobilis-ation	48(h)	42 (IC50) (39-45)	µg Cu/L	m	83	Markich et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	natural freshwater from Paddy's Creek NSW	25±1	7.8		140			immobilis-ation	48(h)	39 (IC50) (37-41)	µg Cu/L	m	83	Markich et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conductivity (µS/cm)	Hardness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Crustacea	cladoceran (*Ceriodaphnia dubia*)	female <24-h old neonates	static	natural freshwater from Paddy's Creek NSW	25±1	7.8		375			immobilisation	48(h)	44 (IC50) (41-47)	µg Cu/L	m	83	Markich et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	neonate	static	moderately hardwater	25±1	7.5 ±0.3	350.2 ±38.7	82.4±6			mortality	48(h)	18 (LC50) (14.7-21.8)	µg/L	m	87	Cooper et al. (2009)
		cladoceran (*Ceriodaphnia dubia*)	neonate	semi-static	moderately hardwater	25±1	7.5 ±0.3	350.2 ±38.7	82.4±6			reproduction	7(d)	1.3 (NOEC) 2.6 (LOEC) 1.8 (EC50) (1.6-2.1)	µg/L	m	87	Cooper et al. (2009)
		cladoceran (*Ceriodaphnia dubia*)	neonate	semi-static	moderately hardwater	25±1	7.5 ±0.3	350.2 ±38.7	82.4±6			survival	7(d)	5.2 (NOEC) 10.6 (LOEC)	µg/L	m	87	Cooper et al. (2009)
		cladoceran (*Daphnia carinata*)	neonate	static	moderately hardwater	25±1	7.5 ±0.3	350.2 ±38.7	82.4±6			mortality	48(h)	37.3 (LC50) (29.1-47.5)	µg/L	m	87	Cooper et al. (2009)
		cladoceran (*Moinodaphnia macleayi*)	adults, 2nd reproductive instar	semi-static	filtered water Magela Creek, NT	27±1						feeding rate	20(h)	13 (EC5) >15 (EC20) >15 (EC50) 18 (LC35) 22 (LC100)	µg/L	m	87	Orchard et al. (2002)
		cladoceran (*Moinodaphnia macleayi*)	<6 days old	semi-static	filtered water Magela Creek, NT	27±1						feeding rate	5-6(d)	9.2 (NOEC) 19 (LOEC)	µg/L	m	82	Orchard et al. (2002)
		cladoceran (*Moinodaphnia macleayi*)	<6 days old	semi-static	filtered water Magela Creek, NT	27±1						feeding rate	5-6(d)	23 (EC50) (17-24) 26 (LC50) (23-31)	µg/L	m	87	Orchard et al. (2002)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22±1	8±1	97±1				mortality	24(h)	1495 (LC50) (788-1558)	µg/L	NR	77	Khan & Nugegoda (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Crustacea	yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22±1	8±1	97±1				mortality	48(h)	993 (LC50)	µg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22±1	8±1	97±1				mortality	72(h)	509 (LC50)	µg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22±1	8±1	97±1				mortality	96(h)	379 (LC50) (275-444)	µg/L	NR	77	Khan & Nugegoda (2007)
Copper	Mollusca	bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	6.5					duration valve opening	48(h)	75 (MDEC) 14 (MDEC) 211 (MDEC) 72 (BEC10) 13 (BEC10) 202 (BEC10) 82.3 (EC20) 15.9 (EC20) 236 (EC20) 20 (EC50) (19.2-20.8) 279 (EC50) (268-290) 97 (EC50) (93-101) 24.1 (EC80) 115 (EC80) 330 (EC80)	µg/L	m	79	Markich et al. (2003)
		bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	6.8					duration valve opening	48(h)	16.2 (MDEC) 15.3 (BEC10) 18.4 (EC20) 22.8 (EC50) (21.9-23.7) 28 (EC80)	µg/L	m	79	Markich et al. (2003)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Mollusca	bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	7					duration valve opening	48(h)	20 (MDEC) 426 (MDEC) 157 (MDEC) 150 (BEC10) 413 (BEC10) 19 (BEC10) 21.8 (EC20)	µg/L	m	79	Markich et al. (2003)
		bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	7					duration valve opening	48(h)	173 (EC20) 462 (EC20) 27 (EC50) (26-28) 200 (EC50) (194-206) 525 (EC50) (506-544) 230 (EC80) 32.6 (EC80) 596 (EC80)	µg/L	m	79	Markich et al. (2003)
		bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	7.3					duration valve opening	48(h)	27 (MDEC) 26 (BEC10) 29.6 (EC20) 36 (EC50) (34.5-37.5) 43.1 (EC80)	µg/L	m	79	Markich et al. (2003)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Mollusca	bivalve (*Hyridella depressa*)	shell length 27-77mm	flow-through	synthetic Hawkes-bury-Nepean River water	20 ±0.1	7.5					duration valve opening	48(h)	668 (MDEC) 32 (MDEC) 265 (MDEC) 30 (BEC10) 255 (BEC10) 626 (BEC10) 286 (EC20) 35.8 (EC20) 718 (EC20) 44 (EC50) (42.3-45.7) 319 (EC50) (312-326) 792 (EC50) (767-817) 54.9 (EC80) 356 (EC80) 874 (EC80)	µg/L	m	79	Markich et al. (2003)
Iron	Crustacea	yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22±2	7±0.5	99±2				mortality	24(h)	177 (LC50) (141-287)	mg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22±2	7 ±0.5	99±2				mortality	48(h)	117 (LC50) (97-155)	mg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22±2	7 ±0.5	99±2				mortality	72(h)	71 (LC50) (61-84)	mg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22±2	7 ±0.5	99±2				mortality	96(h)	51 (LC50) (43-58)	mg/L	NR	77	Khan & Nugegoda (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Lead	Crustacea	cladoceran (*Ceriodaphnia dubia*)	neonate	semi-static	moderately hardwater	25±1	7.5 ±0.3	350.2 ±38.7	82.4±6			survival	7(d)	9 (NOEC) 17.9 (LOEC)	µg/L	m	87	Cooper et al. (2009)
		cladoceran (*Ceriodaphnia dubia*)	neonate	semi-static	moderately hardwater	25±1	7.5 ±0.3	350.2 ±38.7	82.4±6			reproduc-tion	7(d)	2.1 (NOEC) 4.5 (LOEC) 5.1 (EC50) (3.5-7.5)	µg/L	m	87	Cooper et al. (2009)
		cladoceran (*Ceriodaphnia dubia*)	neonate	static	moderately hardwater	25±1	7.5 ±0.3	350.2 ±38.7	82.4±6			mortality	48(h)	208.8 (LC50) (160.1-272.2)	µg/L	m	87	Cooper et al. (2009)
		cladoceran (*Daphnia carinata*)	neonate	static	moderately hardwater	25±1	7.5 ±0.3	350.2 ±38.7	82.4±6			mortality	48(h)	444 (LC50) (330.2-597.1)	µg/L	m	87	Cooper et al. (2009)
Nickel	Crustacea	yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22 ±0.5	7±1	102±0.5				mortality	24(h)	1580 (LC50) (1082-10514)	mg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22 ±0.5	7±1	102±0.5				mortality	48(h)	1110 (LC50) (788-4197)	mg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22 ±0.5	7±1	102±0.5				mortality	72(h)	468 (LC50) (393-543)	mg/L	NR	77	Khan & Nugegoda (2007)
		yabby or crayfish (*Cherax destructor*)	juveniles (28d)	semi-static	carbon filtered Melb mains water	22 ±0.5	7±1	102±0.5				mortality	96(h)	327 (LC50) (290-388)	mg/L	NR	77	Khan & Nugegoda (2007)
Uranium	Chloro-phyta	green algae (*Chlorella* sp.)	NR	static	synthetic Magela Creek water	29±1	6.4-6.6					cell division	72(h)	38 (NOEC) 70 (LOEC)	µg/L	m	73	Hogan et al. (2005b)
		green algae (*Chlorella* sp.)	NR	static	synthetic Magela Creek water	29±1	6.4-6.6					cell division	72(h)	74 (IC50) (48-103)	µg/L	m	78	Hogan et al. (2005b)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Uranium	Chloro-phyta	green algae (*Chlorella* sp.)	NR	static	Magela Creek water	29±1	6.2-6.4					cell division	72(h)	109 (NOEC) 136 (LOEC)	µg/L	m	73	Hogan et al. (2005b)
		green algae (*Chlorella* sp.)	NR	static	Magela Creek water	29±1	6.2-6.4					cell division	72(h)	166 (IC50) (157-173)	µg/L	m	78	Hogan et al. (2005b)
		green algae (*Chlorella* sp.)	NR	static	Magela Creek water	29±1	6.2-6.6					cell division	72(h)	157 (NOEC) 187 (LOEC)	µg/L	m	73	Hogan et al. (2005b)
		green algae (*Chlorella* sp.)	NR	static	Magela Creek water	29±1	6.2-6.6					cell division	72(h)	238 (IC50) (233-241)	µg/L	m	78	Hogan et al. (2005b)
		green algae (*Chlorella* sp.)	NR	static	Magela Creek water	29±1	6.3-6.6					cell division	72(h)	72 (NOEC) 120 (LOEC)	µg/L	m	73	Hogan et al. (2005b)
		green algae (*Chlorella* sp.)	NR	static	Magela Creek water	29±1	6.3-6.6					cell division	72(h)	137 (IC50) (122-150)	µg/L	m	78	Hogan et al. (2005b)
		green algae (*Chlorella* sp.)	NR	static	Magela Creek water	29±1	6.4-6.8					cell division	72(h)	150 (NOEC) 179 (LOEC)	µg/L	m	73	Hogan et al. (2005b)
		green algae (*Chlorella* sp.)	NR	static	Magela Creek water	29±1	6.4-6.8					cell division	72(h)	177 (IC50) (148-210)	µg/L	m	78	Hogan et al. (2005b)
Uranium	Magnolio-phyta	duckweed (*Lemna aequinoctialis*)	12 fronds	semi-static	synthetic freshwater	27±1	6.5 ±0.2					growth	96(h)	112 (MDEC) 758 (EC50) (723-793)	µg/L	m	89	Charles et al. (2006)
Uranium	Cnidaria	hydra (*Hydra viridissima*)	adults	semi-static	synthetic Magela Creek water	27±1	6.0 ±0.3	23	6.6	4	<0.2	population growth	96(h)	32 (MDEC) 114 (EC50) (121-107)	µg/L	m	96	Riethmuller et al. (2001)
		hydra (*Hydra viridissima*)	adults	semi-static	synthetic Magela Creek water	27±1	6.0 ±0.3	23	165	4	<0.2	population growth	96(h)	90 (MDEC) 177 (EC50) (166-188)	µg/L	m	96	Riethmuller et al. (2001)
		hydra (*Hydra viridissima*)	adults	semi-static	synthetic Magela Creek water	27±1	6.0 ±0.3	23	165	102	<0.2	population growth	96(h)	42 (MDEC) 171 (EC50) (150-192)	µg/L	m	96	Riethmuller et al. (2001)
		hydra (*Hydra viridissima*)	adults	semi-static	synthetic Magela Creek water	27±1	6.0 ±0.3	23	330	4	<0.2	population growth	96(h)	62 (MDEC) 219 (EC50) (192-246)	µg/L	m	96	Riethmuller et al. (2001)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Uranium	Mollusca	mussel (*Velesunio angasi*)	females only	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					duration valve opening	48(h)	388 (MDEC) 362 (BEC10) 554 (EC50) (528-580)	µg/L	m	79	Markich (2003)
		mussel (*Velesunio angasi*)	females only	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					valve adductions	48(h)	253 (MDEC) 238 (BEC10) 387 (EC50) (356-418)	µg/L	m	79	Markich (2003)
		mussel (*Velesunio angasi*)	males	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					duration valve opening	48(h)	388 (MDEC) 367 (BEC10) 559 (EC50) (533-585)	µg/L	m	79	Markich (2003)
		mussel (*Velesunio angasi*)	males	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					valve adductions	48(h)	256 (MDEC) 243 (BEC10) (528-580) 395 (EC50) (364-426)	µg/L	m	79	Markich (2003)
		mussel (*Velesunio angasi*)	shell length 13-48mm	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					duration valve opening	48(h)	350 (MDEC) 326 (BEC10) 509 (EC50)	µg/L	m	79	Markich (2003)
		mussel (*Velesunio angasi*)	shell length 13-48mm	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					valve adductions	48(h)	226 (MDEC) 212 (BEC10) 354 (EC50)	µg/L	m	79	Markich (2003)
		mussel (*Velesunio angasi*)	shell length 48-56mm	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					duration valve opening	48(h)	387 (MDEC) 365 (BEC10) 555 (EC50) (529-581)	µg/L	m	79	Markich (2003)
		mussel (*Velesunio angasi*)	shell length 48-56mm	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					valve adductions	48(h)	256 (MDEC) 241 (BEC10) 392 (EC50) (361-423)	µg/L	m	79	Markich (2003)
		mussel (*Velesunio angasi*)	shell length 56-71mm	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					duration valve opening	48(h)	423 (MDEC) 399 (BEC10) 604 (EC50) (577-631)	µg/L	m	79	Markich (2003)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Uranium	Mollusca	mussel (*Velesunio angasi*)	shell length 56-71mm	flow-through	synthetic Magela Creek water	28 ±0.1	6.0 ±0.1					valve adductions	48(h)	281 (MDEC) 266 (BEC10) 426 (EC50) (396-460)	µg/L	m	79	Markich (2003)
Zinc	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	48(h)	0.31 (NOEC) 0.57 (LOEC)	µmol/L	m	70	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	48(h)	1.3 (EC50) (1.2-1.4)	µmol/L	m	75	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	72(h)	0.31 (NOEC) 0.57 (LOEC)	µmol/L	m	70	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic softwater	27	7.5					growth rate	72(h)	1.4 (EC50) (1.2-1.5)	µmol/L	m	75	Franklin et al. (2002)
		green algae (*Chlorella* sp.)	exponential growth phase	static	JM/5 medium	27±1						growth	72(h)	97 (NOEC) <99 (NOEC) 77 (NOEC) 66 (NOEC) <89 (NOEC) 120 (NOEC) 265 (LOEC) 89 (LOEC) 99 (LOEC) 164 (LOEC) 156 (LOEC) 152 (LOEC)	µg/L	m	67	Johnson et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conductivity (µS/cm)	Hardness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Zinc	Chlorophyta	green algae (*Chlorella* sp.)	exponential growth phase	static	JM/5 medium	27±1						growth	72(h)	102 (IC10) (35-41) 37 (IC10) (19-255) 48 (IC10) (14-114) 42 (IC10) (15-102) 31 (IC10) (21-47) 67 (IC10) (0-142) 52 (IC10) 84 (IC10) 87 (IC10) (28-119) 191 (IC25) (172-217) 93 (IC25) (48-306) 142 (IC25) 105 (IC25) (36-123) 146 (IC25) (22-244)	µg/L	m	72	Johnson et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Zinc	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	JM/5 medium	27±1						growth	72(h)	121 (IC25) (87-160) 116 (IC25) (0-199) 176 (IC25) (137-214) 142 (IC25) 273 (IC50) 254 (IC50) (242-271) 203 (IC50) (163-339) 275 (IC50) (204-324) 269 (IC50) (153-331) 194 (IC50) (112-312) 186 (IC50) (126-232) 364 (IC50) (285-599) 226 (IC50)	µg/L	m	72	Johnson et al. (2007)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	5.5	160	40-48			growth	48(h)	370 (MDEC) 2700 (IC50) (2600-2800)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	6	160	40-48			growth	48(h)	350 (MDEC) 1680 (IC50) (1590-1770)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	6.5	160	40-48			growth	48(h)	105 (MDEC) 970 (IC50) (920-1020)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	7	160	40-48			growth	48(h)	93 (MDEC) 630 (IC50) (600-660)	µg/L	m	86	Wilde et al. (2006)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Zinc	Chloro-phyta	green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	7.5	160	40-48			growth	48(h)	16 (MDEC) 160 (IC50) (148-172)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Chlorella* sp.)	exponential growth phase	static	synthetic freshwater	27	8	160	40-48			growth	48(h)	5.9 (MDEC) 52 (IC50) (44-60)	µg/L	m	86	Wilde et al. (2006)
		green algae (*Pseudokirch-neriella subcapitata*)	exponential growth phase	static	US EPA standard medium without EDTA	24						growth	72(h)	60 (IC50) (44-69) 61 (IC50) (38-74) 68 (IC50) (52-81) 69 (IC50) (51-85) 46 (IC50) (24-66) 63 (IC50) (36-84) 68 (IC50) (61-76) 68 (IC50) (62-75) 44 (IC50) (36-62) 49 (IC50) (41-65)	µg/L	m	66	Franklin et al. (2007)
Zinc	Crustacea	cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	5.5	160-180	44	30		immobilis-ation	48(h)	382 (EC50) (331-433)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	6.5	160-180	44	30		immobilis-ation	48(h)	680 (EC50) 550 (EC50) 540 (EC50) 505(EC50) 413 (EC50) (388-437)	µg/L	m	90	Hyne et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	pH	Conduct-ivity (µS/cm)	Hard-ness	Alkalinity (mg $CaCO_3$/L)	Organic Carbon (mg/L)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Zinc	Crustacea	cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	7.5	160-180	44	30		immobilis-ation	48(h)	155 (EC50) (130-185) 200 (EC50) (186-214)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	7.5	160-180	374	30		immobilis-ation	48(h)	390 (EC50) (295-510)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	8.4	160-180	44	125		immobilis-ation	48(h)	70 (EC50) (60-80)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia* cf *dubia*)	< 24-h old neonates	static	synthetic softwater	25±1	8.4	160-180	374	125		immobilis-ation	48(h)	160 (EC50)	µg/L	m	90	Hyne et al. (2005)
		cladoceran (*Ceriodaphnia dubia*)	neonate	semi-static	moderately hardwater	25±1	7.5 ±0.3	350.2 ± 38.7	82.4±6			reproduc-tion	7(d)	13 (NOEC) 25.1 (LOEC) 21.8 (EC50) (11.5-30.3)	µg/L	m	87	Cooper et al. (2009)
		cladoceran (*Ceriodaphnia dubia*)	neonate	semi-static	moderately hardwater	25±1	7.5 ±0.3	350.2 ± 38.7	82.4±6			survival	7(d)	101.1 (NOEC) 216.4 (LOEC)	µg/L	m	87	Cooper et al. (2009)
		cladoceran (*Ceriodaphnia dubia*)	neonate	static	moderately hardwater	25±1	7.5 ±0.3	350.2 ± 38.7	82.4±6			mortality	48(h)	173.5 (LC50) (130.6-232.4)	µg/L	m	87	Cooper et al. (2009)
		Cladoceran (*Daphnia carinata*)	neonate	static	moderately hardwater	25±1	7.5 ±0.3	350.2 ± 38.7	82.4±6			mortality	48(h)	339.8 (LC50) (263.4-438.6)	µg/L	m	87	Cooper et al. (2009)

[a] the concentration is always expressed as a mass of the metal per unit volume unless otherwise stated, TU = toxic units, µmol/L = micromoles per litre, fg/cell = femtograms per cell. [b] m = measured concentration, n = nominal (not measured) concentration, NR = not recorded.

APPENDIX B

SUMMARY OF THE METAL TOXICITY DATA FOR AUSTRALASIAN MARINE/ESTUARINE BIOTA.

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Cadmium	Cnidaria	coral (*Acropora tenuis*)	few hrs prior to spawning	static	seawater			fertilisation	5.5(h)	2000 (NOEC) 5000 (LOEC)	µg/L	m	71	Reichelt-Brushett & Harrison (2005)
Cadmium	Crustacea	amphipod (*Corophium colo*)	adults approx 1.1 mm long	NR	saltwater	20	34	survival	10(d)	1.0 - 3.6 (LC50) 1.9 (LC50)	mg/L	NR	65	McCready et al. (2005)
		amphipod (*Paramoera walkeri*)	healthy	static	filtered seawater	0±0.5		survival	4(d)	670 (LC50) (330-1420)	µg/L	NR	53	Duquesne et al. (2000)
		amphipod (*Paramoera walkeri*)	healthy	static	filtered seawater	0±0.5		survival	8(d)	190 (LC50) (100-340)	µg/L	NR	53	Duquesne et al. (2000)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10 mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	<400 (NOEC) 400 (LOEC)	µg/L	m	80	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	2280 (LC50) (1750-3710)	µg/L	m	79	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	juveniles <7 days old	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	250 (NOEC) 510 (LOEC)	µg/L	m	80	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	juveniles <7 days old	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	520 (LC50) (330-820)	µg/L	m	79	King et al. (2006b)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Cadmium	Crustacea	gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	10(d)	<400 (NOEC) 400 (LOEC)	µg/L	m	80	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	10(d)	470 (LC50) (400-540)	µg/L	m	79	King et al. (2006b)
Cadmium	Echino-dermata	urchin (*Sterechinus neumayeri*)	<3 hrs post fertilisation eggs	static	filtered seawater from Casey Station Antarctica	0±0.5		embryonic development	6-8(d)	2000 (NOEC) 4000 (LOEC) 6940 (EC50)	µg/L	NR	67	King & Riddle (2001)
		urchin (*Sterechinus neumayeri*)	<3 hrs post fertilisation eggs	static	filtered seawater from Casey Station Antarctica	0±0.5		embryonic development	20-23(d)	<200 (NOEC) 200 (LOEC)	µg/L	NR	67	King & Riddle (2001)
Cadmium	Mollusca	abalone (*Haliotis rubra*)	fertilised eggs	static	seawater	20±2		development	48(h)	320 (NOEC) 1280 (LOEC) 520 (EC10) (481-576) 4515 (EC50) (4316-4821)	µg/L	n	76	Gorski & Nugegoda (2006)
Copper	Bacillario-phyta	diatom (*Minutocellus polymorphus*)	exponential growth phase	static	filtered seawater	21		cell division	72(h)	<0.2 (NOEC) 0.2 (LOEC)	µg/L	n	79	Levy et al. (2007)
		diatom (*Minutocellus polymorphus*)	exponential growth phase	static	filtered seawater	21		cell division	72(h)	0.6 (IC50) (0.5-0.8)	µg/L	n	84	Levy et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Bacillario-phyta	Diatom (*Nitzschia closterium*)	exponential growth phase	static	filtered seawater from Cronulla NSW	22±1		growth rate	48(h)	21 (IC50) (18-24) 18 (IC50) (16-20)	µg Cu/L	NR	79	Hogan et al. (2005a)
		Diatom (*Nitzschia closterium*)	exponential growth phase	static	filtered seawater from Cronulla NSW	22±1		growth rate	48(h)	18 (IC50) (17-20) 22 (IC50) (19-24)	µg Cu/L	NR	79	Hogan et al. (2005a)
		Diatom (*Nitzschia closterium*)	exponential growth phase	static	half strength G medium	27±1		growth	72(h)	10 (NOEC) 5 (NOEC) 16 (NOEC) 7 (NOEC) 7 (NOEC) 6 (NOEC) 3 (NOEC)	µg/L	m	68	Johnson et al. (2007)
		diatom (*Nitzschia closterium*)	exponential growth phase	static	half strength G medium	27±1		growth	72(h)	7 (NOEC) 6 (NOEC) 5 (NOEC) 17 (LOEC) 11 (LOEC) 29 (LOEC) 9 (LOEC) 12 (LOEC) 39 (LOEC) 14 (LOEC) 19 (LOEC) 17 (LOEC) 16 (LOEC)	µg/L	m	68	Johnson et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Bacillario-phyta	diatom (*Nitzschia closterium*)	exponential growth phase	static	half strength G medium	27±1		growth	72(h)	5 (IC10) (1-12) 10 (IC10) (0-20) 14 (IC10) (10-20) 8 (IC10) (1-12) 1 (IC10) (0-4) 9 (IC10) (0-16) 8 (IC10) (7-10) 6 (IC10) (2-9) 15 (IC25) (10-24) 13 (IC25) (9-16) 3 (IC25) (0-30) 11 (IC25) (9-18) 17 (IC25) (10-23)	µg/L	m	72	Johnson et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Bacillario-phyta	diatom (*Nitzschia closterium*)	exponential growth phase	static	half strength G medium	27±1		growth	72(h)	16 (IC25) (0-49) 25 (IC25) (18-57) 10 (IC25) (7-18) 27 (IC50) (14-58) 40 (IC50) 43 (IC50) (39-48) 62 (IC50) 33 (IC50) (0-37) 12 (IC50) (6-36) 51 (IC50) (20-71) 44 (IC50) (27-66) 23 (IC50) (17-33)	µg/L	m	72	Johnson et al. (2007)
		diatom (*Nitzschia closterium*)	exponential growth phase	static	filtered seawater	21		cell division	72(h)	4.4 (NOEC) 5.8 (LOEC) 18 (IC50) (6-30)	µg/L	m	79	Levy et al. (2007)
		diatom (*Nitzschia closterium*)	exponential growth phase	static	filtered seawater	21		growth rate	72(h)	0.8 (NOEC) 1 (NOEC) 1 (LOEC) 1.5 (LOEC) 8 (EC50) (4-10) 7 (EC50) (6-8)	µg Cu/L	m	69	Levy et al. (2009)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Bacillario-phyta	diatom (*Phaeodactylum tricornutum*)	exponential growth phase	static	UV sterilised, filtered seawater	21		growth rate	48(h)	12 (IC50) (11-14) 19 (IC50) (15-24)	µg/L	m	78	Franklin et al. (2004)
		diatom (*Phaeodactylum tricornutum*)	exponential growth phase	static	UV sterilised, filtered seawater	21		growth rate	72(h)	13 (IC50) (11-15) 24 (IC50) (20-29)	µg/L	m	78	Franklin et al. (2004)
		diatom (*Phaeodactylum tricornutum*)	exponential growth phase	static	filtered seawater	21		cell division	72(h)	<1.5 (NOEC) 1.5 (LOEC) 8 (IC50) (4.7-8.3)	µg/L	m	79	Levy et al. (2007)
Copper	Dino-flagellata	dinoflagellate (*Heterocapsa niei*)	exponential growth phase	static	UV sterilised, filtered seawater	21		growth rate	48(h)	14 (IC50) (10-20) 15 (IC50) (14-16)	µg/L	m	78	Franklin et al. (2004)
		dinoflagellate (*Heterocapsa niei*)	exponential growth phase	static	UV sterilised, filtered seawater	21		growth rate	72(h)	16 (IC50) (13-18) 16 (IC50) (15-17)	µg/L	m	78	Franklin et al. (2004)
		dinoflagellate (*Heterocapsa niei*)	exponential growth phase	static	filtered seawater	21		cell division	72(h)	4.8 (IC50) (3.5-7.2)	µg/L	m	84	Levy et al. (2007)
Copper	Chlorophyta	green algae (*Dunaliella tertiolecta*)	exponential growth phase	static	filtered seawater	21		cell division	72(h)	8 (NOEC) 42 (LOEC) 530 (IC50) (450-600)	µg/L	m	79	Levy et al. (2007)
		green flagellate (*Micromonas pusilla*)	exponential growth phase	static	UV sterilised, filtered seawater	21		growth rate	48(h)	3.3 (IC50) (3.1-3.6)	µg/L	m	78	Franklin et al. (2004)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Chlorophyta	green flagellate (*Micromonas pusilla*)	exponential growth phase	static	UV sterilised, filtered seawater	21		growth rate	72(h)	3.1 (IC50) (2.4-4.2)	µg/L	m	78	Franklin et al. (2004)
		green flagellate (*Micromonas pusilla*)	exponential growth phase	static	filtered seawater	21		cell division	72(h)	0.3 (NOEC) 0.6 (LOEC) 1.2 (IC50) (1.1-1.4)	µg/L	n	79	Levy et al. (2007)
		green flagellate (*Proteomonas sulcata*)	exponential growth phase	static	filtered seawater	27		cell division	72(h)	<5 (NOEC) 4.2 (IC50) (2.4-7.5)	µg/L	m	79	Levy et al. (2007)
		green flagellate (*Tetraselmis* sp.)	exponential growth phase	static	filtered seawater	21		cell division	72(h)	7 (NOEC) 22 (LOEC) 47 (IC50) (46-49)	µg/L	m	79	Levy et al. (2007)
Copper	Prymnesio-phyta	haptophyte (*Emiliania huxleyi*)	exp growth phase with coccoliths	static	filtered seawater	21		cell division	72(h)	8 (NOEC) 15 (IC50) (12-18)	µg/L	m	79	Levy et al. (2007)
		haptophyte (*Emiliania huxleyi*)	exp growth phase without coccoliths	static	filtered seawater	21		cell division	72(h)	9 (NOEC) 20 (IC50) (16-26)	µg/L	m	84	Levy et al. (2007)
		haptophyte (*Gephyrocapsa oceanica*)	exp growth phase with coccoliths	static	filtered seawater	21		cell division	72(h)	<1 (NOEC) 1 (LOEC) 17 (IC50) (17-18)	µg/L	m	79	Levy et al. (2007)
		haptophyte (*Gephyrocapsa oceanica*)	exp growth phase without coccoliths	static	filtered seawater	21		cell division	72(h)	1.3 (NOEC) 2.6 (LOEC) >25 (IC50)	µg/L	m	84	Levy et al. (2007)
		haptophyte (*Isochrysis* sp.)	exponential growth phase	static	filtered seawater	27		cell division	72(h)	<1.1 (NOEC) 1.1 (LOEC) 4 (IC50) (3.8-4.2)	µg/L	m	79	Levy et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Annelida	flatworm (*Phrikoceros baibaiye*)	adults	semi-static	unfiltered seawater	19.5±3	37±3	mortality	96(h)	15 (NOEC) 20 (NOEC) 11 (NOEC) 28 (LOEC) 40 (LOEC) 45 (LOEC)	µg/L	m	80	Hughes et al. (2005)
		flatworm (*Phrikoceros baibaiye*)	adults	semi-static	unfiltered seawater	19.5±3	37±3	mortality	96(h)	16 (LC50) (10-25) 17 (LC50) (12-24) 14 (LC50) (7-29)	µg/L	m	85	Hughes et al. (2005)
		worm (*Australonereis ehlersi*)	adults	NR	seawater			survival	4(d)	140 (LOEC)	mg/kg	NR	39	Simpson (2005)
		worm (*Spirorbis nordenskjoldi*)	healthy, attached to algae	semi-static	seawater	0.5		behaviour	10(d)	11 (NOEC) 24 (LOEC) 20 (EC50) (17-24)	µg/L	m	70	Hill et al. (2009)
		worm (*Spirorbis nordenskjoldi*)	healthy, attached to algae	semi-static	seawater	0.5		mortality	10(d)	215 (NOEC) 365 (LOEC) 570 (LC50) (420-1100)	µg/L	m	70	Hill et al. (2009)
Copper	Bryozoa	bryozoan (*Bugula neritina*)	larvae	static	filtered seawater	21±0.4		%attachment	12(d)	50 (NOEC) 50 (NOEC) 100 (LOEC) 100 (LOEC)	µg/L	m	75	Piola & Johnston (2006)
		bryozoan (*Bugula neritina*)	larvae	static	filtered seawater	21±0.4		growth	12(d)	50 (NOEC) 50 (NOEC) 50 (NOEC) 50 (NOEC) 100 (LOEC) 100 (LOEC) 100 (LOEC) 100 (LOEC)	µg/L	m	75	Piola & Johnston (2006)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Bryozoa	bryozoan (*Bugula neritina*)	larvae	static	filtered seawater	21±0.4		survival	12(d)	50 (NOEC) 50 (NOEC) 50 (NOEC) 50 (NOEC) 50 (NOEC) 25 (NOEC) 100 (LOEC)	µg/L	m	75	Piola & Johnston (2006)
		bryozoan (*Bugula neritina*)	larvae	static	filtered seawater	21±0.4		survival	12(d)	100 (LOEC) 50 (LOEC) 100 (LOEC) 100 (LOEC) 100 (LOEC)	µg/L	m	75	Piola & Johnston (2006)
Copper	Cnidaria	coral (*Acropora longicyathus*)	few hrs prior to spawning	static	seawater			fertilisation	5.5(h)	15.3 (NOEC) 23.6 (LOEC) 15.2 (EC50) (12-19.2)	µg/L	m	77	Reichelt-Brushett & Harrison (2005)
		coral (*Acropora tenuis*)	larvae 5 days after fert.	static	seawater			% settlement	48(h)	17.3 (NOEC) 42 (LOEC) 35 (EC50) (32-37)	µg/L	m	77	Reichelt-Brushett & Harrison (2000)
		coral (*Acropora tenuis*)	few hrs prior to spawning	static	seawater			fertilisation	5.5(h)	33.5 (NOEC) 41.9 (LOEC) 39.7 (EC50) (36-43.7)	µg/L	m	71	Reichelt-Brushett & Harrison (2005)
		coral (*Goniastrea aspera*)	few hrs prior to spawning	static	seawater			fertilisation	5.5(h)	10 (NOEC) 12.8 (NOEC) 20.4 (LOEC) 20 (LOEC) 18.5 (EC50) (12-19.2) 24.7 (EC50) (15.5-30)	µg/L	m	71	Reichelt-Brushett & Harrison (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Cnidaria	sea anemone (*Actinia* sp.)	adults	semi-static	unfiltered seawater	19.5±3	37±3	mortality	96(h)	207 (NOEC) 160 (NOEC) 629 (LOEC) 265 (LOEC)	µg/L	m	80	Hughes et al. (2005)
		sea anemone (*Actinia* sp.)	adults	semi-static	unfiltered seawater	19.5±3	37±3	mortality	96(h)	182 (LC50) (118-279) 347 (LC50)	µg/L	m	85	Hughes et al. (2005)
		soft coral (*Lobophytum compactum*)	mature 35-50cm diameter	static	seawater			fertilisation	NR	69 (NOEC) 36 (NOEC) 69 (LOEC)	µg/L	m	66	Reichelt-Brushett & Michalek-Wagner (2005)
		soft coral (*Lobophytum compactum*)	mature 35-50cm diameter	static	seawater			fertilisation	NR	117 (LOEC) 261 (EC50)	µg/L	m	66	Reichelt-Brushett & Michalek-Wagner (2005)
Copper	Crustacea	amphipod (*Corophium colo*)	adults	NR	seawater			survival	4(d)	1800 (LOEC) 0.12 (LOEC)	mg/kg	NR	39	Simpson (2005)
		amphipod (*Corophium colo*)	adults	NR	seawater			survival	4(d)	2.1 (LC50)	mg/L	NR	44	Simpson (2005)
		amphipod (*Corophium colo*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	950 (NOEC) >950 (LOEC)	µg Cu/L	m	69	King et al. (2006a)
		amphipod (*Corophium colo*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	>950 (LC50)	µg Cu/L	m	75	King et al. (2006a)
		amphipod (*Corophium insidiosum*)	adults	NR	seawater			survival	4(d)	200 (LOEC)	mg/kg	NR	39	Simpson (2005)
		amphipod (*Corophium insidiosum*)	adults	NR	seawater			survival	4(d)	0.28 (LC50) (0.1-0.4)	mg/L	NR	44	Simpson (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Crustacea	amphipod (*Paramoera walkeri*)	healthy	static	filtered seawater	0±0.5		survival	4(d)	970 (LC50) (530-1910)	µg/L	NR	53	Duquesne et al. (2000)
		amphipod (*Paramoera walkeri*)	healthy	static	filtered seawater	0±0.5		survival	8(d)	290 (LC50) (150-510)	µg/L	NR	53	Duquesne et al. (2000)
		amphipod (*Paramoera walkeri*)	healthy	semi-static	filtered seawater from Casey Station Antarctica	−1.25 ±0.2		survival	4(d)	100 (NOEC) 970 (LC50)	µg/L	n	66	Liess et al. (2001)
		amphipod (*Paramoera walkeri*)	healthy	semi-static	filtered seawater from Casey Station Antarctica	−1.25 ±0.2		survival	12(d)	100 (NOEC) 100 (NOEC) 21 (LOEC) 100 (LOEC)	µg/L	n	66	Liess et al. (2001)
		amphipod (*Paramoera walkeri*)	healthy	semi-static	filtered seawater from Casey Station Antarctica	−1.25 ±0.2		survival	21(d)	100 (NOEC) 100 (NOEC) 45.7 (LOEC) 3 (LOEC)	µg/L	n	66	Liess et al. (2001)
		estuarine amphipod (*Hyale crassicornis*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	90 (NOEC) 190 (LOEC) >190 (LC50)	µg Cu/L	m	75	King et al. (2006a)
		estuarine amphipod (*Hyale crassicornis*)	juveniles <7 days old	static	filtered seawater	21±1		survival	96(h)	<100 (NOEC) <100 (NOEC) 100 (LOEC) 100 (LOEC >100 (LC50) >100 (LC50)	µg Cu/L	m	75	King et al. (2006a)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Crustacea	gammarid amphipod (*Melita awa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	80 (NOEC) 150 (LC50) (120-190)	µg Cu/L	m	75	King et al. (2006a)
		gammarid amphipod (*Melita awa*)	juveniles <7 days old	static	filtered seawater	21±1		survival	96(h)	<40 (NOEC) 40 (LOEC) 120 (LC50) (98-120)	µg Cu/L	m	75	King et al. (2006a)
		gammarid amphipod (*Melita matilda*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	120 (NOEC) 220 (LC50) (200-240)	µg Cu/L	m	75	King et al. (2006a)
		gammarid amphipod (*Melita matilda*)	juveniles <7 days old	static	filtered seawater	21±1		survival	96(h)	50 (NOEC) 100 (LOEC) 180 (LC50) (150-210)	µg Cu/L	m	75	King et al. (2006a)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	80 (NOEC) 170 (LOEC) 180 (LC50) (40-260)	µg Cu/L	m	75	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	juveniles <7 days old	static	filtered seawater	21±1		survival	96(h)	50 (NOEC) 90 (LOEC) 120 (LC50)	µg Cu/L	m	75	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	340 (NOEC) >340 (LOEC) >340 (LC50)	µg/L	m	80	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater			survival	10(d)	80 (NOEC)	µg Cu/L	m	69	Simpson & King (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Crustacea	gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater			survival	10(d)	198 (LBC50) 235 (LBC50) 207 (LEC50)	µg Cu/g tissue	m	73	Simpson & King (2005)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater			survival	10(d)	180 (LC50) (30-260)	µg Cu/L	m	75	Simpson & King (2005)
		gammarid amphipod (*Melita plumulosa*)	adults	NR	seawater			survival	4(d)	160 (LOEC) 0.34 (LOEC)	mg/kg	NR	39	Simpson (2005)
		gammarid amphipod (*Melita plumulosa*)	adults	NR	seawater			survival	4(d)	0.47 (LC50) (0.39-0.62)	mg/L	NR	44	Simpson (2005)
		gammarid amphipod (*Melita plumulosa*)	11 days old	static	filtered seawater	21		body length	4(d)	99 (NOEC) 156 (NOEC) 83 (NOEC) 100 (NOEC) 187 (LOEC) 240 (LOEC) 156 (LOEC) 99 (LOEC) 230 (LC50) 190 (LC50) 220 (LC50) 220 (LC50) (209-231)	µg/L	m	71	Spadaro et al. (2008)
		gammarid amphipod (*Melita plumulosa*)	11 days old	static	filtered seawater	21		body length	10(d)	36 (NOEC) <20 (NOEC) 64 (LOEC) 20 (LOEC) 76 (LC50) 36 (LC50)	µg/L	m	71	Spadaro et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Crustacea	gammarid amphipod (*Melita plumulosa*)	14 days old	static	filtered seawater	21		body length	4(d)	118 (NOEC) 59 (LOEC) 230 (LC50) (201-259)	µg/L	m	71	Spadaro et al. (2008)
		gammarid amphipod (*Melita plumulosa*)	18 days old	static	filtered seawater	21		body length	4(d)	290 (NOEC) 130 (LOEC) 308 (LC50) (231-385)	µg/L	m	71	Spadaro et al. (2008)
		gammarid amphipod (*Melita plumulosa*)	30 days old	static	filtered seawater	21		body length	4(d)	313 (NOEC) 146 (LOEC) 470 (LC50) (360-580)	µg/L	m	71	Spadaro et al. (2008)
		gammarid amphipod (*Melita plumulosa*)	5 days old	static	filtered seawater	21		body length	4(d)	75 (NOEC) 44 (LOEC) 120 (LC50) (116-124)	µg/L	m	71	Spadaro et al. (2008)
		gammarid amphipod (*Melita plumulosa*)	8 days old	static	filtered seawater	21		body length	4(d)	57 (NOEC) <57 (LOEC) 182 (LC50)	µg/L	m	71	Spadaro et al. (2008)
		Scud (*Grandidierella japonica*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	90 (NOEC) 190 (LOEC) 250 (LC50) (120-410)	µg Cu/L	m	75	King et al. (2006a)
		shrimp (*Alope orientalis*)	adults	semi-static	unfiltered seawater	19.5±3	37±3ppt	mortality	96(h)	85 (NOEC) 50 (NOEC) 80 (NOEC) 125 (LOEC) 125 (LOEC) 205 (LOEC) 128 (LC50)	µg/L	m	80	Hughes et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Crustacea	shrimp (*Alope orientalis*)	adults	semi-static	unfiltered seawater	19.5±3	37±3ppt	mortality	96(h)	54 (LC50) (31-93) 86 (LC50) (63-118)	µg/L	m	80	Hughes et al. (2005)
Copper	Echino-dermata	urchin (*Sterechinus neumayeri*)	<3 hrs post fertilisation eggs	static	filtered seawater from Casey Station Antarctica	0±0.5		embryonic development	20-23(d)	<2 (NOEC) 8 (NOEC) 12 (LOEC) 2 (LOEC) 1.4 (EC50)	µg/L	NR	67	King & Riddle (2001)
		urchin (*Sterechinus neumayeri*)	<3 hrs post fertilisation eggs	static	filtered seawater from Casey Station Antarctica	0±0.5		embryonic development	6-8(d)	11.4 (EC50)	µg/L	NR	68	King & Riddle (2001)
Copper	Mollusca	abalone (*Haliotis rubra*)	fertilised eggs	static	seawater	20±2		development	48(h)	1 (NOEC) 4 (LOEC) 3.7 (EC10) (3.5-3.8)	µg/L	n	76	Gorski & Nugegoda (2006)
		abalone (*Haliotis rubra*)	fertilised eggs	static	seawater	20±2		development	48(h)	7.1 (EC50) (6.7-7.5)	µg/L	n	76	Gorski & Nugegoda (2006)
		bivalve (*Mysella anomala*)	40mm long	static	filtered seawater		30-31	survival	96(h)	480 (NOEC) 140 (NOEC) 900 (LOEC) 180 (LOEC)	µg/L	m	66	King et al. (2004)
		bivalve (*Mysella anomala*)	40mm long	static	filtered seawater		30-31	survival	96(h)	1500 (LC50) (1300-1800) 210 (LC50) (200-220)	µg/L	m	71	King et al. (2004)
		bivalve (*Mysella anomala*)	adults	NR	seawater			survival	4(d)	900 (LOEC) 180 (LOEC) 90 (LOEC)	mg/kg	NR	39	Simpson (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Copper	Mollusca	bivalve (*Soletellina alba*)	15-20mm long	static	filtered seawater		30-31	survival	96(h)	57 (NOEC) 90 (LOEC) 120 (LC50) (100-140)	µg/L	m	71	King et al. (2004)
		bivalve (*Tellina deltoidalis*)	15-20mm long	static	filtered seawater		30-31	survival	96(h)	65 (NOEC) 140 (LOEC) 150 (LC50) (110-200)	µg/L	m	66	King et al. (2004)
		bivalve (*Tellina deltoidalis*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater			survival	10(d)	70 (NOEC	µg Cu/L	m	69	Simpson & King (2005)
		bivalve (*Tellina deltoidalis*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater			survival	10(d)	247 (LEC50) (217-273) 370 (LBC50) 320 (LBC50)	µg Cu/g tissue	m	73	Simpson & King (2005)
		bivalve (*Tellina deltoidalis*)	adults 5-9 mm length	static	filtered seawater			survival	10(d)	130 (LC50) (90-150)	µg Cu/L	m	75	Simpson & King (2005)
		bivalve (*Tellina deltoidalis*)	adults	NR	seawater			survival	4(d)	110 (LOEC)	mg/kg	NR	39	Simpson (2005)
Iron	Mollusca	abalone (*Haliotis rubra*)	fertilised eggs	static	seawater	20±2		development	48(h)	1280 (NOEC) 5120 (LOEC) 4364 (EC10) (4058-4578) 5111 (EC50) (4860-5375)	µg/L	n	76	Gorski & Nugegoda (2006)
Lead	Annelida	worm (*Spirorbis nordenskjoldi*)	healthy, attached to algae	semi-static	seawater	0.5		health	10(d)	80 (NOEC) 435 (LOEC) 365 (EC50) (140-620)	µg/L	m	70	Hill et al. (2009)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Lead	Annelida	worm (*Spirorbis nordenskjoldi*)	healthy, attached to algae	semi-static	seawater	0.5		mortality	10(d)	>2905 (NOLC)	µg/L	m	70	Hill et al. (2009)
Lead	Cnidaria	coral (*Acropora longicyathus*)	few hrs prior to spawning	static	seawater			fertilisation	5.5(h)	451 (NOEC) 855 (LOEC) 1453 (EC50) (1156-1780)	µg/L	m	77	Reichelt-Brushett & Harrison (2005)
		coral (*Acropora tenuis*)	few hrs prior to spawning	static	seawater			fertilisation	5.5(h)	790 (NOEC) 1982 (LOEC) 1801 (EC50) (1352-2400)	µg/L	m	77	Reichelt-Brushett & Harrison (2005)
		coral (*Goniastrea aspera*)	few hrs prior to spawning	static	seawater			fertilisation	5.5(h)	5455 (NOEC) 6409 (LOEC) 2467 (EC50) (691-8807)	µg/L	m	77	Reichelt-Brushett & Harrison (2005)
Lead	Crustacea	gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	850 (NOEC) 1680 (LOEC) 3000 (LC50) (2580-3560)	µg/L	m	80	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	juveniles <7 days old	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	400 (NOEC) 600 (LOEC) 1530 (LC50)	µg/L	m	80	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	10(d)	190 (NOEC) 390 (LOEC) 1270 (LC50) (940-1550)	µg/L	m	80	King et al. (2006b)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Lead	Echino-dermata	urchin (*Sterechinus neumayeri*)	<3 hrs post fertilisation eggs	static	filtered seawater from Casey Station Antarctica	0±0.5		embryonic development	20-23(d)	3200 (NOEC) >3200 (LOEC)	µg/L	NR	67	King & Riddle (2001)
Lead	Mollusca	abalone (*Haliotis rubra*)	fertilised eggs	static	seawater	20±2		development	48(h)	320 (NOEC) 1280 (LOEC) 3718 (EC10) (3650-4159) 4102 (EC50) (3891-4398)	µg/L	n	76	Gorski & Nugegoda (2006)
Mercury	Mollusca	abalone (*Haliotis rubra*)	fertilised eggs	static	seawater	20±2		development	48(h)	8 (NOEC) 16 (LOEC) 11.9 (EC10) (4.7-16.1) 19.8 (EC50) (14-28)	µg/L	n	76	Gorski & Nugegoda (2006)
Nickel	Cnidaria	coral (*Goniastrea aspera*)	few hrs prior to spawning	static	seawater			fertilisation	5.5(h)	5 (NOEC) 100 (LOEC)	µg/L	m	71	Reichelt-Brushett & Harrison (2005)
Nickel	Crustacea	gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	4310 (NOEC) 8660 (LOEC) 16800 (LC50) (13900-22800)	µg/L	m	80	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	juveniles <7 days old	static	filtered seawater from Port Hacking NSW	21±1		survival	96(h)	860 (NOEC) 1730 (LOEC) 2430 (LC50) (1760-3090)	µg/L	m	80	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	10(d)	2130 (NOEC) 4280 (LOEC) 2590 (LC50) (2030-3050)	µg/L	m	80	King et al. (2006b)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Zinc	Bacillario-phyta	diatom (*Nitzschia closterium*)	exponential growth phase	static	half strength G medium	27±1		growth	72(h)	66 (NOEC) <89 (NOEC) <99 (NOEC) 85 (NOEC) 120 (NOEC) 77 (NOEC) 77 (NOEC) 62 (NOEC) 143 (LOEC) 164 (LOEC) 156 (LOEC) 265 (LOEC) 99 (LOEC) 89 (LOEC) 172 (LOEC) 145 (LOEC)	µg/L	m	68	Johnson et al. (2007)
		diatom (*Nitzschia closterium*)	exponential growth phase	static	half strength G medium	27±1		growth	72(h)	31 (IC10) (21-47) 42 (IC10) (15-102) 37 (IC10) (19-35)	µg/L	m	72	Johnson et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Zinc	Bacillario-phyta	diatom (*Nitzschia closterium*)	exponential growth phase	static	half strength G medium	27±1		growth	72(h)	84 (IC10) 87 (IC10) (28-119) 67 (IC10) (0-142) 52 (IC10) 48 (IC10) (14-114) 226 (IC50) 273 (IC50) 146 (IC25) (22-244) 121 (IC25) (87-160) 176 (IC25) (137-214)	µg/L	m	72	Johnson et al. (2007)
		diatom (*Nitzschia closterium*)	exponential growth phase	static	half strength G medium	27±1		growth	72(h)	105 (IC25) (36-123) 142 (IC25) 116 (IC25) (0-199) 142 (IC25) 93 (IC25) (48-306) 203 (IC50) (163-339) 364 (IC50) (285-599) 186 (IC50) (126-232) 194 (IC50) (112-312) 275 (IC50) (204-324) 269 (IC50) (153-331)	µg/L	m	72	Johnson et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Zinc	Annelida	worm (*Spirorbis nordenskjoldi*)	healthy, attached to algae	semi-static	seawater	0.5		health	10(d)	1660 (LOEC) 770 (NOEC) 1210 (EC50) (900-1470)	µg/L	m	70	Hill et al. (2009)
		worm (*Spirorbis nordenskjoldi*)	healthy, attached to algae	semi-static	seawater	0.5		mortality	10(d)	>4910 (NOLC)	µg/L	m	70	Hill et al. (2009)
Zinc	Cnidaria	coral (*Acropora tenuis*)	few hrs prior to spawning	static	seawater			fertilisation	5.5(h)	<10 (NOEC) 10 (LOEC)	µg/L	m	71	Reichelt-Brushett & Harrison (2005)
Zinc	Crustacea	amphipod (*Chaetocoro-phium* cf. *lucasi*)	juveniles <7 days old	static	filtered seawater	21±1		survival	96(h)	380 (NOEC) 760 (LOEC) 1130 (LC50) (870-1390)	µg Zn/L	m	75	King et al. (2006a)
		amphipod (*Corophium colo*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	4500 (NOEC) >4500 (LOEC) >4500 (LC50)	µg Zn/L	m	75	King et al. (2006a)
		amphipod (*Grandidieralla japonica*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	630 (NOEC) 1280 (LOEC) 1560 (LC50) (1090-2010)	µg Zn/L	m	69	King et al. (2006a)
		estuarine amphipod (*Hyale longicornis*)	juveniles <7 days old	static	filtered seawater	21±1		survival	96(h)	500 (NOEC) >500 (LOEC) >500 (LC50)	µg Zn/L	m	75	King et al. (2006a)
		estuarine amphipod (*Hyale longicornis*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	970 (NOEC) 1940 (LOEC) >1940 (LC50)	µg Zn/L	m	75	King et al. (2006a)
		gammarid amphipod (*Melita awa*)	juveniles <7 days old	static	filtered seawater	21±1		survival	96(h)	440 (NOEC) 650 (LOEC) 710 (LC50) (470-960)	µg Zn/L	m	75	King et al. (2006a)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Zinc	Crustacea	gammarid amphipod (*Melita awa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	480 (NOEC) 710 (LC50) (570-830)	µg Zn/L	m	75	King et al. (2006a)
		gammarid amphipod (*Melita matilda*)	juveniles <7 days old	static	filtered seawater	21±1		survival	96(h)	<240 (NOEC) 240 (LOEC) 650 (LC50) (90-1450)	µg Zn/L	m	75	King et al. (2006a)
		gammarid amphipod (*Melita matilda*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	230 (NOEC) 470 (LOEC) 730 (LC50) (560-890)	µg Zn/L	m	75	King et al. (2006a)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	10(d)	<520 (NOEC) 520 (LOEC) 900 (LC50) (750-1020)	µg/L	m	80	King et al. (2006a)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	1530 (NOEC) 2070 (LOEC) 3530 (LC50) (2820-5740)	µg/L	m	80	King et al. (2006b)
		gammarid amphipod (*Melita plumulosa*)	juveniles <7 days old	static	filtered seawater from Port Hacking NSW	21±1	30	survival	96(h)	250 (NOEC) 500 (LOEC) 640 (LC50) (390-910)	µg/L	m	80	King et al. (2006a)
		gammarid amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	static	filtered seawater	21±1		survival	10(d)	<520 (NOEC) 520 (LOEC) 900 (LC50) (750-1020)	µg Zn/L	m	69	King et al. (2006a)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp. (°C)	Salinity (‰)	Endpoint	Duration	Toxic conc & measure of toxicity	Unit of toxic conc[a]	Conc type[b]	Quality score (%)	Reference
Zinc	Echino-dermata	urchin (*Sterechinus neumayeri*)	<3 hrs post fertilisation eggs	static	filtered seawater from Casey Station Antarctica	0±0.5		embryonic development	20-23(d)	160 (NOEC) 320 (LOEC) 326.8 (EC50)	µg/L	NR	67	King & Riddle (2001)
		urchin (*Sterechinus neumayeri*)	<3 hrs post fertilisation eggs	static	filtered seawater from Casey Station Antarctica	0±0.5		embryonic development	6-8(d)	800 (NOEC) 1200 (LOEC) 2230 (EC50)	µg/L	NR	67	King & Riddle (2001)
Zinc	Mollusca	abalone (*Haliotis rubra*)	fertilised eggs	static	seawater	20±2		development	48(h)	8 (NOEC) 16 (LOEC) 20.4 (EC10) (18.5-21.9)	µg/L	n	76	Gorski & Nugegoda (2006)
		abalone (*Haliotis rubra*)	fertilised eggs	static	seawater	20±2		development	48(h)	42.3 (EC50) (38.5-46.2)	µg/L	n	76	Gorski & Nugegoda (2006)
		bivalve (*Mysella anomala*)	4-5mm long	static	filtered seawater		30-31	survival	96(h)	<200 (NOEC) 2000 (LOEC) 4500 (LC50) (3800-5400)	µg/L	m	66	King et al. (2004)
		bivalve (*Mysella anomala*)	40mm long	static	filtered seawater		30-31	survival	96(h)	5800 (NOEC) >5800 (LOEC) >5800 (LC50)	µg/L	m	66	King et al. (2004)
		bivalve (*Soletellina alba*)	15-20mm long	static	filtered seawater		30-31	survival	96(h)	1700 (NOEC) 2300 (LOEC) 2900 (LC50) (2700-3100)	µg/L	m	66	King et al. (2004)
		bivalve (*Tellina deltoidalis*)	15-20mm long	static	filtered seawater		30-31	survival	96(h)	970 (NOEC) >970 (LOEC) >970 (LC50)	µg/L	m	66	King et al. (2004)

[a] the concentration is always expressed as a mass of the metal per unit volume unless otherwise stated. [b] m = measured concentration, n = nominal (not measured) concentration, NR = not recorded.

APPENDIX C

SUMMARY OF THE METAL TOXICITY DATA FOR AUSTRALASIAN SEDIMENT BIOTA.

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Cadmium	Crustacea	amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment and filtered seawater	21±1	survival	10(d)	>820 (EC50)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment and filtered seawater	21±1	growth	10(d)	>820 (EC20)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	growth	42(d)	>630 (EC20)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	survival	42(d)	>630 (EC50)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	gravidity	42(d)	>630 (EC50)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	fertility	42(d)	>630 (EC50)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	1630 (LC50)	mg/kg	m	80	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	620 (NOEC) 820 (LOEC)	mg/kg	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	>260 (LC50)	mg/kg	m	80	King et al. (2006a)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	260 (NOEC) >260 (LOEC)	mg/kg	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	sexually mature males & females	Semi-static	sediment and filtered seawater	24	fecundity	12(d)	~9 (EC50)	mg/kg	m	69	Mann et al. (2009)
		amphipod (*Melita plumulosa*)	sexually mature males & females	Semi-static	sediment and filtered seawater	24	fecundity	12(d)	~6 (EC50)	mg/kg	m	69	Mann et al. (2009)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Copper	Bacillariophyta	diatom (*Entomoneis* cf. *punctulata*)	adults	NR	marine sediments	NR	survival	10(d)	850 (LC50)	mg/kg	NR	44	Simpson (2005)
Copper	Annelida	worm (*Australonereis ehlersi*)	40mm long	Static	sediment and filtered seawater	NR	survival	10(d)	1300 (<LC10)	µg/L	m	71	King et al. (2004)
		worm (*Australonereis ehlersi*)	adults	NR	marine sediments	NR	survival	10(d)	1150 (LC50)	mg/kg	NR	44	Simpson (2005)
		worm (*Australonereis ehlersi*)	adults	NR	seawater and marine sediment	NR	survival	10(d)	380 (LEC50)	mg/kg tissue	NR	44	Simpson (2005)
		worm (*Nephtys australiensis*)	40mm long	Static	sediment and filtered seawater	NR	survival	10(d)	1300 (<LC10)	µg/L	m	71	King et al. (2004)
		worm (*Nephtys australiensis*)	adults	NR	seawater and marine sediment	NR	survival	10(d)	380 (LEC50)	mg/kg tissue	NR	44	Simpson (2005)
		worm (*Nephtys australiensis*)	adults	NR	marine sediments	NR	survival	10(d)	2000 (LC50)	mg/kg	NR	44	Simpson (2005)
		worm (*Austriella* cf. *plicifera*)	shell length 1cm	Static	sediment and filtered seawater	21	reburial	10(d)	389 (ET50) (358-423) 145 (ET50) (123-170) 87.1 (ET50) (82-92) 115 (ET50) (107-123) 138 (ET50) (130-146) 115 (ET50) (108-123)	min	m	70	Hutchins et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Copper	Annelida	worm (*Austriella* cf. *plicifera*)	shell length 1cm	Static	sediment and filtered seawater	21	reburial	10(d)	126 (ET50) (119-133) 112 (ET50) (109-115) 112 (ET50) (105-120) 132 (ET50) (123-141) 151 (ET50) (136-169) 151 (ET50) (143-161) 97.7 (ET50) (94-101) 91.2 (ET50) (87-96) 126 (ET50) (117-135)	min	m	70	Hutchins et al. (2008)
Copper	Crustacea	amphipod (*Chaetocorophium* cf. *lucasi*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC02)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Chaetocorophium* cf. *lucasi*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC60)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Corophium colo*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC10)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Corophium colo*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC90)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Corophium colo*)	adults	NR	marine sediments	NR	survival	10(d)	4100 (LC50)	mg/kg	NR	44	Simpson (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Copper	Crustacea	amphipod (*Corophium colo*)	adults	NR	seawater and marine sediment	NR	survival	10(d)	420 (LEC50)	mg/kg tissue	NR	44	Simpson (2005)
		amphipod (*Corophium insidiosum*)	adults	NR	marine sediments	NR	survival	10(d)	1500 (LC50)	mg/kg	NR	44	Simpson (2005)
		amphipod (*Corophium insidiosum*)	adults	NR	seawater and marine sediment	NR	survival	10(d)	250 (LEC50)	mg/kg tissue	NR	44	Simpson (2005)
		amphipod (*Melita awa*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC98)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Melita awa*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC88)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Melita matilda*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC05)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Melita matilda*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC75)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	fertility	42(d)	250 (NOEC) 440 (LOEC)	mg/kg	m	78	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	fertility	42(d)	290 (EC50) (230-340) 330 (EC50) (280-350) 328 (EC50)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	gravidity	42(d)	410 (EC50) (350-540)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	growth	42(d)	250 (NOEC) 440 (LOEC)	mg/kg	m	78	Gale et al. (2006)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Copper	Crustacea	amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	growth	42(d)	>350 (EC20) 420 (EC20) (350-525) >350 (EC50)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment and filtered seawater	21±1	growth	10(d)	1140 (EC20)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	survival	42(d)	>350 (EC50) 800 (EC50) >530 (EC50)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment and filtered seawater	21±1	survival	10(d)	770 (EC50) (700-880)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	1520 (LC50)	mg/kg	m	80	King et al. (2006b)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	<550 (NOEC) 550 (LOEC)	mg/kg	m	77	King et al. (2006b)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	1390 (LC51) 1230 (LC48) 1150 (LC68) 1280 (LC53)	mg/kg	m	80	King et al. (2006a)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC48)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	26 (LC53) 41 (LC51) 27 (LC68) 26 (LC48)	µg/L overlying water	m	80	King et al. (2006a)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Copper	Crustacea	amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	23 (LC68) 10 (LC48) 17 (LC51) 12 (LC53)	µg/L pore water	m	80	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	790 (LC50)	mg/kg	m	80	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	460 (NOEC) 820 (LOEC)	mg/kg	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	1150 (LC90)	mg/kg	m	80	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	1340 (LC82) 1390 (LC89)	mg/kg	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	1300 (LC90)	mg Cu/kg	n	75	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	28 (LC82) 41 (LC89) 27 (LC90)	ug/L overlying water	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	17 (LC89) 7 (LC82) 23 (LC90)	µg/L pore water	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	sexually mature males & females	Semi-static	sediment and filtered seawater	24	fecundity	12(d)	200 (NOEC) 300 (LOEC)	mg/kg	m	72	Mann et al. (2009)
		amphipod (*Melita plumulosa*)	sexually mature males & females	Semi-static	sediment and filtered seawater	24	survival females	12(d)	500 (LC87)	mg/kg	m	72	Mann et al. (2009)
		amphipod (*Melita plumulosa*)	sexually mature males & females	Semi-static	sediment and filtered seawater	24	survival males	12(d)	500 (LC48)	mg/kg	m	72	Mann et al. (2009)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Copper	Crustacea	amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment and filtered seawater	NR	survival	10(d)	1300 (LC50)	µg Cu/g sediment	m	75	Simpson & King (2005)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment and filtered seawater	NR	survival	10(d)	520 (NOEC)	µg Cu/g sediment	m	69	Simpson & King (2005)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment and filtered seawater	NR	survival	10(d)	212 (LEC50) 115 (LBC50) 168 (LBC50)	µg Cu/g tissue	m	73	Simpson & King (2005)
		amphipod (*Melita plumulosa*)	adults	NR	seawater and marine sediment	NR	survival	10(d)	210 (LEC50)	mg/kg tissue	NR	44	Simpson (2005)
	Mollusca	bivalve (*Mysella anomala*)	4-5mm long	Static	sediment and filtered seawater	NR	survival	10(d)	1300 (<LC10)	µg/L	m	71	King et al. (2004)
		bivalve (*Mysella anomala*)	adults	NR	marine sediments	NR	survival	10(d)	3700 (LC50)	mg/kg	NR	44	Simpson (2005)
		bivalve (*Mysella anomala*)	adults	NR	seawater and marine sediment	NR	survival	10(d)	420 (LEC50)	mg/kg tissue	NR	44	Simpson (2005)
		bivalve (*Soletellina alba*)	15-20mm long	Static	sediment and filtered seawater	NR	survival	10(d)	1300 (LC80)	µg/L	m	71	King et al. (2004)
		bivalve (*Soletellina alba*)	adults	NR	marine sediments	NR	survival	10(d)	1000 (LC50)	mg/kg	NR	44	Simpson (2005)
		bivalve (*Soletellina alba*)	adults	NR	seawater and marine sediment	NR	survival	10(d)	43 (LEC50)	mg/kg tissue	NR	44	Simpson (2005)
		bivalve (*Tellina deltoidalis*)	4-5mm long	Static	sediment and filtered seawater	NR	survival	10(d)	1300 (LC100)	µg/L	m	71	King et al. (2004)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Copper	Mollusca	bivalve (*Tellina deltoidalis*)	adults 8-10mm long, aged 2-3 months	Static	sediment and filtered seawater	NR	survival	10(d)	650 (NOEC)	µg Cu/g sediment	m	69	Simpson & King (2005)
		bivalve (*Tellina deltoidalis*)	adults 8-10mm long, aged 2-3 months	Static	sediment and filtered seawater	NR	survival	10(d)	1020 (LC50)	µg Cu/g sediment	m	75	Simpson & King (2005)
		bivalve (*Tellina deltoidalis*)	adults 8-10mm long, aged 2-3 months	Static	sediment and filtered seawater	NR	survival	10(d)	330 (LBC50) 290 (LBC50) 267 (LEC50) (226-308)	µg Cu/g tissue	m	73	Simpson & King (2005)
		bivalve (*Tellina deltoidalis*)	adults	NR	seawater and marine sediment	NR	survival	10(d)	260 (LEC50)	mg/kg tissue	NR	44	Simpson (2005)
Lead	Crustacea	amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	3560 (NOEC) >3560 (LOEC) >3560 (LC50)	mg/kg	m	77	King et al. (2006b)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	1980 (LC50)	mg/kg	m	80	King et al. (2006b)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	580 (NOEC) 1020 (LOEC)	mg/kg	m	77	King et al. (2006b)
		amphipod (*Melita plumulosa*)	sexually mature males & females	Semi-static	sediment and filtered seawater	24	fecundity	12(d)	300 (NOEC)	mg/kg	m	72	Mann et al. (2009)
		amphipod (*Melita plumulosa*)	sexually mature males & females	Semi-static	sediment and filtered seawater	24	fecundity	12(d)	~200 (EC50) ~100 (EC50)	mg/kg	m	69	Mann et al. (2009)
Nickel	Mollusca	bivalve (*Mysella anomala*)	4-5mm long	Static	sediment and filtered seawater	NR	survival	10(d)	4000 (<LC10)	µg/L	m	71	King et al. (2004)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Nickel	Crustacea	amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	770 (NOEC) >770 (LOEC) >770 (LC50)	mg/kg	m	77	King et al. (2006b)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	300 (LC50)	mg/kg	m	80	King et al. (2006b)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	<215 (NOEC) 215 (LOEC)	mg/kg	m	77	King et al. (2006b)
Zinc	Annelida	worm (*Australonereis ehlersi*)	40mm long	Static	sediment and filtered seawater	NR	survival	10(d)	4000 (<LC10)	µg/L	m	71	King et al. (2004)
		worm (*Nephtys australiensis*)	40mm long	Static	sediment and filtered seawater	NR	survival	10(d)	4000 (<LC10)	µg/L	m	71	King et al. (2004)
Zinc	Crustacea	amphipod (*Chaetocorophium* cf. *lucasi*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000 (LC37)	mgZn/kg	n	75	King et al. (2006a)
		amphipod (*Chaetocorophium* cf. *lucasi*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000 (LC78)	mg Zn/kg	n	75	King et al. (2006a)
		amphipod (*Corophium colo*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000 (LC02)	mg Zn/kg	n	75	King et al. (2006a)
		amphipod (*Corophium colo*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000(LC20)	mg Zn/kg	n	75	King et al. (2006a)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Zinc	Crustacea	amphipod (*Melita awa*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000(LC76)	mg Zn/kg	n	75	King et al. (2006a)
		amphipod (*Melita awa*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000(LC97)	mg Zn/kg	n	75	King et al. (2006a)
		amphipod (*Melita matilda*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000(LC30)	mg Zn/kg	n	75	King et al. (2006a)
		amphipod (*Melita matilda*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000(LC90)	mg Zn/kg	n	75	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	fertility	42(d)	730(NOEC) 980(LOEC)	mg/kg	m	78	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	fertility	42(d)	<630(EC50) 1120(EC50) (1040-1180)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	gravidity	42(d)	>1770(EC50)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	growth	42(d)	>1770(EC20)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	growth	42(d)	1280(NOEC) 1540(LOEC)	mg/kg	m	78	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment and filtered seawater	21±1	growth	10(d)	3650(EC20) (2900-4260)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Semi-static	sediment and filtered seawater	21±1	survival	42(d)	>1520(EC50) >1770(EC50)	mg/kg	m	82	Gale et al. (2006)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment and filtered seawater	21±1	survival	10(d)	3420(EC50) (3320-3510)	mg/kg	m	82	Gale et al. (2006)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Zinc	Crustacea	amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	3480(LC26) 4530(LC18) 3490(LC11)	mg/kg	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	>9040(LC50) 2290(NOEC) 4530(LOEC)	mg/kg	m	80	King et al. (2006a)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000(LC12)	mg Zn/kg	n	75	King et al. (2006a)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	81(LC26) 66(LC11) 48(LC18)	µg/L overlying water	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	adults 8-10mm long, aged 2-3 months	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	17(LC18) 31(LC11) 135(LC26)	µg/L pore water	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	4670(LC91) 4530(LC81)	mg/kg	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	1790(LC50) <2290(NOEC) 2290(LOEC)	mg/kg	m	80	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	3480(LC79)	mg/kg	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	uncontaminated sediment from Bonnet Bay Sydney	21±1	survival	10(d)	4000(LC80)	mg Zn/kg	n	75	King et al. (2006a)

Metal	Division/ phylum	Species	Life Stage	Mode of exposure	Test medium	Temp (°C)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc. type[b]	Quality score (%)	Reference
Zinc	Crustacea	amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	48(LC81) 270(LC91) 81(LC79)	μg/L overlying water	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	juveniles <7 days old	Static	sediment with overlying filtered seawater	21±1	survival	10(d)	135(LC79) 17(LC81) 330(LC91)	μg/L pore water	m	77	King et al. (2006a)
		amphipod (*Melita plumulosa*)	sexually mature males & females	Semi-static	sediment and filtered seawater	24	fecundity	12(d)	~450(EC50) ~280(EC50)	mg/kg	m	69	Mann et al. (2009)
		amphipod (*Melita plumulosa*)	sexually mature males & females	Semi-static	sediment and filtered seawater	24	fecundity	12(d)	500(NOEC)	mg/kg	m	72	Mann et al. (2009)
Zinc	Mollusca	bivalve (*Soletellina alba*)	15-20mm long	Static	sediment and filtered seawater	NR	survival	10(d)	4000(<LC10)	μg/L	m	71	King et al. (2004)
		bivalve (*Tellina deltoidalis*)	15-20mm long	Static	sediment and filtered seawater	NR	survival	10(d)	4000(LC10)	μg/L	m	71	King et al. (2004)

[a] the concentration is always expressed as a mass of the metal per unit mass of the sediment unless otherwise stated. The concentration is alternately expressed as mass of metal per unit volume of either the pore water or overlying water or as the mass of metal per mass of organism tissue. [b] m = measured concentration, n = nominal (not measured) concentration, NR = not recorded.

APPENDIX D

SUMMARY OF THE METAL TOXICITY DATA FOR AUSTRALASIAN TERRESTRIAL BIOTA.

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnolio-phyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	28.8 (EC10) 15.3 (EC10) (0.88-265) 19.4 (EC10) ($4.1x10^{-10}$-$9.2x10^{11}$) 28.4 (EC10) ($1.8x10^{-42}$-$4.4x10^{44}$) 16.7 (EC10) (2.5-109) 26.78 (EC10) ($1.1x10^{-9}$-$6.5x10^{11}$) 9.8 (EC10) (0.34-279) 6.64 (EC10) ($9.3x10^{-13}$-$4.7x10^{13}$) 9.5 (EC10) ($4.5x10^{-5}$-$1.8x10^{6}$) 30 (EC10) 0.2 (EC10) ($1.4x10^{-43}$-$3x10^{43}$) 10.6 (EC10) (2.6-43.9) 13.1 (EC10) ($7.1x10^{-7}$-$2.4x10^{8}$) 12.3 (EC10) (0.07-2300)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnolio-phyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	1.5 (EC10) ($1.1x10^{-7}$-$2.1x10^{7}$) 4 (EC10) (0.73-22.1) 5.5 (EC10) (3.5-8.6) 7.7 (EC10) (5.4-10.9) 3.3 (EC10) (0.06-196) 5.8 (EC10) (3.5-9.7) 4.5 (EC10) (0.02-1256) 5.6 (EC10) (2.7-11.63) 2.3 (EC10) ($2x10^{-6}$-$2.4x10^{6}$) 0.7 (EC10) (0.0008-717) 3.2 (EC10) (1.2-8.6) 3.9 (EC10) (0.04-395) 13.7 (EC10) (0.0026-72400) 3.1 (EC10) (2.2-4.24) 4.8 (EC10) (7.5-3.1) 7.5 (EC10) (5.3-10.6)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnoliophyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	1.98 (EC10) ($6.2x10^{-6}$-$6.3x10^{5}$) 4.4 (EC10) ($7.4x10^{-12}$-$2.6x10^{12}$) 4.1 (EC10) (0.05-326) 1.7 (EC10) ($1.7x10^{-5}$-$1.6x10^{5}$) 0.9 (EC10) (0.78-1.1) 0.8 (EC10) ($8.6x10^{-18}$-$7.5x10^{16}$) 3.2 (EC10) (0.6-17.7) 7.3 (EC10) (5-10.6) 5.4 (EC10) (0.95-30.2) 0.05 (EC10) ($5.8x10^{-23}$-$4x10^{19}$) 2.6 (EC10) (0.26-25.9) 3.1 (EC10) (0.82-11.7) 2.2 (EC10) (0.009-509) 3.4 (EC10) (0.05-216) 7.4 (EC10) (5.2-10.6)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnolio-phyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	2.9 (EC10) (0.01-713) 4.9 (EC10) (0.2-125) 5.3 (EC10) ($1.7x10^{-8}$-$1.7x10^{9}$) 7 (EC10) (4.4-10.9) 1.8 (EC10) (0.001-3160) 3.8 (EC10) (1.9-7.8) 3.1 (EC10) (0.05-181) 2.5 (EC10) (0.07-86.7) 7.2 (EC10) (5.2-9.9) 12.3 (EC20) (0.001-114000) 18.1 (EC20) (2.35-139.8) 30.8 (EC20) 22.2 (EC20) ($4x10^{-4}$-$1.25x10^{6}$) 27.4 (EC20) ($1.8x10^{-7}$-$4.1x10^{9}$) 26.4 (EC20) (9.9-70) 17.1 (EC20) (7.3-39.8)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnolio-phyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	14.6 (EC20) (1.64-130) 5.2 (EC20) (0.25-107) 5.2 (EC20) (1.45-18.4) 4.7 (EC20) (1.3-16.9) 6.3 (EC20) (0.09-441) 5 (EC20) (2.9-8.4) 7.2 (EC20) (4.2-12.4) 1.6 (EC20) ($1.3x10^{-13}$-$2x10^{13}$) 4.1 (EC20) (0.7-22.7) 6.9 (EC20) ($1x10^{-8}$-$4.6x10^{9}$) 7.4 (EC20) (5.3-10.5) 3.5 (EC20) ($2.8x10^{-4}$-$4.3x10^{4}$) 2.7 (EC20) ($1.0x10^{-5}$-$6.7x10^{5}$) 1.37 (EC20) (0.006-308) 0.66 (EC20) ($4.5x10^{-34}$-$9.7x10^{32}$)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnoliophyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	8 (EC20) (6.1-10.4) 5 (EC20) (2.4-10.4) 7.6 (EC20) (2.1-27.9) 29.1 (EC20) ($5.8x10^{-23}$-$1.5x10^{25}$) 7 (EC20) (4.9-10) 6.6 (EC20) (0.6-75.4) 16.2 (EC20) (0.037-7132) 29.6 (EC20) 7.8 (EC20) (6.1-9.9) 5.7 (EC20) (4-8) 8 (EC20) (6.2-10.4) 3.2 (EC20) (0.05-217) 2.6 (EC20) ($3.5x10^{-4}$-$1.9x10^{4}$) 7.8 (EC20) (5.8-10.5) 8.3 (EC20) (6.6-10.6) 4.4 (EC20) (1.6-11.9) 6 (EC20) (0.23-158)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnolio-phyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	3.8 (EC20) ($1.2x10^{-4}$-$1.2x10^{5}$) 4.2 (EC20) (3.2-5.3) 4.1 (EC20) (0.07-257) 0.18 (EC20) ($5.0x10^{-18}$-$6.2x10^{15}$) 19.9 (EC20) (0.04-9240) 4.2 (EC20) (0.3-56.7) 6 (EC20) (0.2-184) 9.9 (EC20) ($1.9x10^{-8}$-$5.3x10^{9}$) 1.5 (EC20) (1.3-1.7) 8 (EC20) (6-10.6) 4.5 (EC20) (0.2-91.9) 16.5 (EC20) (0.4-631) 6.1 (EC20) ($1.6x10^{-6}$-$2.3x10^{7}$) 2.7 (EC20) (0.007-964) 4.7 (EC20) (0.21-105) 24.1 (EC50) (8.6-67.9)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnolio-phyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	28.6 (EC50) (0.001-734000) 31.1 (EC50) 32.4 (EC50) 21.8 (EC50) (2.3-205.7) 13.8 (EC50) (6.6-28.8) 54.6 (EC50) ($5.3x10^{-6}$-$5.7x10^{8}$) 19.7 (EC50) ($8.5x10^{-7}$-$4.5x10^{8}$) 27.2 (EC50) (2.8-260) 57.7 (EC50) (7.1-467) 38.5 (EC50) (19.6-75.4) 28.8 (EC50) (10.8-76.9) 8.9 (EC50) (7.7-10.2) 18.9 (EC50) (0.28-1263) 30.4 (EC50) ($7.4x10^{-9}$-$1.2x10^{11}$) 4.7 (EC50) ($6.3x10^{-15}$-$3.5x10^{15}$) 9.2 (EC50) (4.9-17.2)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnolio-phyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	11.2 (EC50) (8.2-15.5) 5 (EC50) ($1.0x10^{-6}$-$2.4x10^{7}$) 7.1 (EC50) (0.02-2900) 12.6 (EC50) (10.3-15.4) 9.4 (EC50) (0.07-1325) 11.2 (EC50) (2.8-45) 11.5 (EC50) (1.97-66.9) 11.3 (EC50) (2.5-50.4) 9 (EC50) (8-10.2) 14.8 (EC50) (0.0005-478000) 9.1 (EC50) (0.1-731) 11.2 (EC50) (1-125) 10.8 (EC50) (7.6-15.4) 20.6 (EC50) ($1.9x10^{-10}$-$2.2x10^{12}$) 8.8 (EC50) (3.9-20) 8 (EC50) (4.6-14)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnoliophyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	8.2 (EC50) (1.9-36.5) 12.8 (EC50) (2.2-73.2) 7.7 (EC50) (6.5-9) 7.8 (EC50) (6.2-9.9) 7.1 (EC50) (6.3-8) 3.3 (EC50) (3-3.6) 5.7 (EC50) (0.05-632) 5.3 (EC50) (0.2-134) 4 (EC50) (0.2-76.4) 1.6 (EC50) ($6.7x10^{-10}$-$3.9x10^{9}$) 8.1 (EC50) (5.1-13.1) 9.6 (EC50) (9.1-10) 10.1 (EC50) (9.5-10.7) 8.3 (EC50) (2.06-33.6) 7.8 (EC50) (0.004-15600) 8.9 (EC50) (8-10) 9.8 (EC50) (8.6-11.1)	µmol/L	n	62	Scott et al. (2008)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Aluminium	Magnolio-phyta	burr medic (*Medicago polymorpha*) Different cultivars were tested.	seed	pulse & static	nutrient solution	21±1	4.3			root growth	3(d)	10.3 (EC50) (3.2-33.4) 6 (EC50) (0.7-52.7) 7.8 (EC50) (1.15-52.6) 9.1 (EC50) (8.2-10.2)	µmol/L	n	62	Scott et al. (2008)
		wheat (*Triticum aestivum*)	3 day old seedlings; roots 20 mm	static	0.2 mM solution $CaCl_2$	25	4.3			root length	48(h)	0.96 (EA25) (0.83-1.21) 1.67 (EA50) (1.5-2.1)	µM	m	81	Fortunati et al. (2005)
Cadmium	Pterido-phyta	fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	<500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Cadmium	Pterido-phyta	fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	100-500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	100-500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	~50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Cadmium	Pterido-phyta	fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
Cadmium	Arthro-poda	collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	growth	42(d)	50 (NOEC) 200 (LOEC)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	reproduc-tion	42(d)	65 (EC10) 125 (EC50)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	Survival	42(d)	50 (NOEC) 200 (LOEC)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	time to 1st young	42(d)	50 (NOEC) 200 (LOEC)	mg/kg	n	76	Nursita et al. (2005)
Chromium	Pterido-phyta	fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum cartilagineum*)	3-4 months with 3-4 frond	static	Debco potting mix with 10% perlite					root dry wt	20(w)	100-500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Chromium	Pterido-phyta	fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Chromium	Pterido-phyta	fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
Copper	Bacteria	nitrifying microbes	indigenous	static	soil	20	4		5.6	nitrification	28(d)	1 (EC10) 5 (EC30) 59 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	4.4		1.2	nitrification	28(d)	47 (EC10) 70 (EC30) 140 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	4.5		1.4	nitrification	28(d)	206 (EC10) 208 (EC30) 211 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	4.8		2.6	nitrification	28(d)	141 (EC10) 225 (EC30) 497 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	4.9		2	nitrification	28(d)	175 (EC10) 228 (EC30) 355 (EC50)	mg/kg	m	81	Broos et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Bacteria	nitrifying microbes	indigenous	static	soil	20	5		1.8	nitrification	28(d)	383 (EC10) 502 (EC30) 797 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	5.1		3.4	nitrification	28(d)	887 (EC10) 914 (EC30) 964 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	5.4		0.9	nitrification	28(d)	34 (EC10) 254 (EC30) 1078 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	6.3		1.8	nitrification	28(d)	502 (EC10) 571 (EC30) 712 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	6.3		1.9	nitrification	28(d)	919 (EC10) 932 (EC30) 953 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	7.3		1.3	nitrification	28(d)	1271 (EC10) 1451 (EC30) 1821 (EC50)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	7.6		1.2	nitrification	28(d)	>2594 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	4		5.6	respiration rate	6(h)	48 (EC10) 134 (EC30) 784 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	4.4		1.2	respiration rate	6(h)	39 (EC10) 111 (EC30) 662 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	4.5		1.4	respiration rate	6(h)	326 (EC10) 450 (EC30) 555 (EC50)	mg/kg	m	81	Broos et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Bacteria	soil microbes	indigenous	static	soil	20	4.8		2.6	respiration rate	6(h)	25 (EC10) 97 (EC30) 940 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	4.9		2	respiration rate	6(h)	255 (EC10) 503 (EC30) 1606 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	5		1.8	respiration rate	6(h)	222 (EC10) 559 (EC30) 2321 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	5.1		3.4	respiration rate	6(h)	202 (EC10) 421 (EC30) 1487 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	5.4		0.9	respiration rate	6(h)	3 (EC10) 31 (EC30) 1078 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	6.3		1.8	respiration rate	6(h)	134 (EC10) 259 (EC30) 795 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	6.3		1.9	respiration rate	6(h)	26 (EC10) 73 (EC30) 431 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	7.3		1.3	respiration rate	6(h)	230 (EC10) 496 (EC30) 1842 (EC50)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	7.6		1.2	respiration rate	6(h)	185 (EC10) 345 (EC30) 1000 (EC50)	mg/kg	m	81	Broos et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnolio-phyta	barley (*Hordeum vulgare*)	seed	static	soil		4	14	5.7	grain yield	9(m)	28 (EC10) 227 (EC50)	mg/kg	m	74	Vic NBRP Unpublished
		barley (*Hordeum vulgare*)	seed	static	soil		5	7	2	grain yield	9(m)	49 (EC10) 515 (EC50)	mg/kg	m	74	Vic NBRP Unpublished
		barley (*Hordeum vulgare*)	seed	static	soil		6.3	7	1.9	grain yield	9(m)	77 (EC10) 720 (EC50)	mg/kg	m	74	SA NBRP Unpublished
		barley (*Hordeum vulgare*)	seed	static	soil		6.7	20	1.8	grain yield	9(m)	222 (EC10) 645 (EC50)	mg/kg	m	74	SA NBRP Unpublished
		barley (*Hordeum vulgare*)	seed	static	soil		7.6	11	1.1	grain yield	9(m)	313 (EC10) 1300 (EC50)	mg/kg	m	74	SA NBRP Unpublished
		candelabra wattle (*Acacia holosericea*)	42 day old seedlings	semi-static	nutrient solution					shoot dry weight	70(d)	0.7 (EC10) 2.2 (EC50)	µM	m	77	Reichman et al. (2006)
		candelabra wattle (*Acacia holosericea*)	42 day old seedlings	semi-static	nutrient solution					root dry wt	70(d)	0.7 (EC10) 2.1 (EC50)	µM	m	77	Reichman et al. (2006)
		colza (*Brassica napus*)	seed	static	soil		4.6	6	2.6	grain yield	9(m)	926 (EC10) 1136 (EC30) 1566 (EC50)	mg/kg	m	74	WA NBRP Unpublished
		colza (*Brassica napus*)	seed	static	soil		5	7	2	grain yield	9(m)	315 (EC10) 452 (EC50)	mg/kg	m	74	Vic NBRP Unpublished

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnolio-phyta	colza (*Brassica napus*)	seed	static	soil		6.7	20	1.8	grain yield	9(m)	1310 (EC10) 1370 (EC50)	mg/kg	m	74	SA NBRP Unpublished
		cotton (*Gossypium* sp.)	seed	static	soil		7.9	10	1.4	grain yield	9(m)	1451 (EC10) 1757 (EC50)	mg/kg	m	74	QLD NBRP Unpublished
		cowpea (*Vigna unguiculata*)	seedlings with radicle length 10mm	static	nutrient solution	25-30				biomass	14(d)	1.7 (EC10)	µM	m	70	Kopittke & Menzies (2006)
		narrow-leaved ironbark (*Eucalyptus crebra*)	42 day old seedlings	semi-static	nutrient solution					root dry wt	70(d)	0.7 (EC10) 1.2 (EC50)	µM	m	77	Reichman et al. (2006)
		narrow-leaved ironbark (*Eucalyptus crebra*)	42 day old seedlings	semi-static	nutrient solution					shoot dry weight	70(d)	0.7 (EC10) 1 (EC50)	µM	m	77	Reichman et al. (2006)
		peanut (*Arachis hypogaea*)	seed	static	soil		4.5	6	1.4	grain yield	9(m)	197 (EC10) 516 (EC50)	mg/kg	m	74	QLD NBRP Unpublished
		peanut (*Arachis hypogaea*)	seed	static	soil		5.4	6	1.8	grain yield	9(m)	398 (EC10) 467 (EC50)	mg/kg	m	74	QLD NBRP Unpublished
		proso millet (*Panicum miliaceum*)	seed	static	soil		5.4	6	1.8	grain yield	9(m)	206 (EC10) 389 (EC50)	mg/kg	m	74	QLD NBRP Unpublished
		river redgum (*Eucalyptus camaldulensis*)	42 day old seedlings	semi-static	nutrient solution					shoot dry weight	70(d)	0.6 (EC10) 1 (EC50)	µM	m	77	Reichman et al. (2006)
		river redgum (*Eucalyptus camaldulensis*)	42 day old seedlings	semi-static	nutrient solution					root dry wt	70(d)	0.6 (EC10) 1 (EC50)	µM	m	77	Reichman et al. (2006)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnolio-phyta	sorghum (*Sorghum* sp.)	seed	static	soil		5.4	6	1.8	grain yield	9(m)	206 (EC10) 318 (EC50)	mg/kg	m	74	QLD NBRP Unpublished
		sorghum (*Sorghum* sp.)	seed	static	soil		7.9	10	1.4	grain yield	9(m)	598 (EC10) 1433 (EC50)	mg/kg	m	74	QLD NBRP Unpublished
		sugarcane (*Saccharum* sp.)	seed	static	soil		4.5	6	1.4	grain yield	9(m)	203 (EC10) 342 (EC50)	mg/kg	m	74	QLD NBRP Unpublished
		triticale (*Tritosecale* sp.)	seed	static	soil		4	14	5.7	grain yield	9(m)	481 (EC10) 1020 (EC30) 2040 (EC50)	mg/kg	m	74	Vic NBRP Unpublished
		triticale (*Tritosecale* sp.)	seed	static	soil		5.4	6	1.8	grain yield	9(m)	274 (EC10) 363 (EC50)	mg/kg	m	74	QLD NBRP Unpublished
		weeping teatree (*Melaleuca leucadendra*)	42 day old seedlings	semi-static	nutrient solution					shoot dry weight	70(d)	0.5 (EC10) 0.8 (EC50)	µM	m	77	Reichman et al. (2006)
		weeping teatree (*Melaleuca leucadendra*)	42 day old seedlings	semi-static	nutrient solution					root dry wt	70(d)	0.5 (EC10) 1 (EC50)	µM	m	77	Reichman et al. (2006)
		wheat (*Triticum aestivum*)	3 day old seedlings; roots 20 mm	static	0.2 mM solution $CaCl_2$	25	4.3			root length	48(h)	0.39 (EA50) (0.35-0.45) 0.17 (EA25) (0.15-0.21) 0.36 (EA50) (0.35-0.4) 0.15 (EA25) (0.13-0.17) 0.34 (EA50) (0.29-0.38) 0.16 (EA25) (0.13-0.2)	µM	m	81	Fortunati et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnolio-phyta	wheat (*Triticum aestivum*)	3 day old seedlings; roots 20 mm	static	0.2 mM solution $CaCl_2$	25	4.3			root length	48(h)	0.36 (EA50) (0.34-0.41) 0.33 (EA50) (0.29-0.39) 0.78 (EA50) (0.7-0.88) 0.61 (EA50) (0.54-0.76) 0.29 (EA25) (0.27-0.32) 0.32 (EA50) (0.28-0.4) 0.15 (EA25) (0.13-0.16) 0.58 (EA25) (0.51-0.65) 0.35 (EA25) (0.31-0.44) 0.47 (EA50) (0.44-0.52) 0.15 (EA25) (0.14-0.17) 7.15 (EA50) (6.8-7.9) 0.12 (EA25) (0.11-0.15)	µM	m	81	Fortunati et al. (2005)
		wheat (*Triticum aestivum*)	seed	static	soil		4		5.6	grain yield	9(m)	284 (EC10) (100-800) 649 (EC50) (390-1080)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4.4		1.3	plant biomass	21(d)	115 (EC10) (72-180) 190 (EC20) (135-265) 450 (EC50) (380-540)	mg/kg	m	74	Warne et al. (2008b)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	soil		4.4		1.2	plant biomass	8(w)	117 (EC10) (37-370) 315 (EC50) (140-715)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		4.4		1.2	grain yield	9(m)	130 (EC10) (58-294) 212 (EC50) (133-340)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4.5		1.4	plant biomass	21(d)	260 (EC10) (230-295) 263 (EC20) (245-285) 270 (EC50) (265-275)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4.6		2.6	plant biomass	21(d)	465 (EC10) (0.15-1555000) 490 (EC20) (2-118000) 530 (EC50) (195-1450)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		4.8		2.6	plant biomass	8(w)	52 (EC10) (14-90) 330 (EC50) (170-650)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		4.8		2.6	grain yield	9(m)	473 (EC10) (132-1700) 1760 (EC50) (795-3900)	mg/kg	m	74	Warne et al. (2008a)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4.9		3.5	plant biomass	21(d)	110 (EC10) (65-195) 225 (EC20) (150-340) 740 (EC50) (595-920)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		4.9		2.0	grain yield	9(m)	148 (EC10) (64-350) 476 (EC50) (270-840)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		5		1.8	plant biomass	8(w)	193 (EC10) (137-272) 272 (EC50) (227-328)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		5		1.8	grain yield	9(m)	209 (EC10) (112-390) 310 (EC50) (230-413)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	5		2	plant biomass	21(d)	490 (EC10) (230-1040) 660 (EC20) (385-1140) 1105 (EC50) (800-1515)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	5			plant biomass	21(d)	465 (EC10) (260-840) 535 (EC20) (350-805) 670 (EC50) (550-820)	mg/kg	m	74	Warne et al. (2008b)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	soil		5.1		3.4	plant biomass	8(w)	144 (EC10) (70-300) 526 (EC50) (335-830)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		5.1		3.4	grain yield	9(m)	787 (EC10) (39-15700) 3170 (EC50) (61-166000)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		5.4		0.9	plant biomass	8(w)	351 (EC10) (0.02-6x10^6) 375 (EC50) (141-996)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		5.4		0.9	grain yield	9(m)	132 (EC10) (55-317) 286 (EC50) (196-420)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	5.4		1.8	plant biomass	21(d)	810 (EC10) (500-1310) 910 (EC20) (640-1290) 1110 (EC50) (945-1310)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	5.6		0.9	plant biomass	21(d)	205 (EC10) (6-6820) 215 (EC20) (155-305) 240 (EC50) (0.25-231000)	mg/kg	m	74	Warne et al. (2008b)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	6		2.9	plant biomass	21(d)	885 (EC10) (255-3060) 1050 (EC20) (470-2350) 1405 (EC50) (1070-1840)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		6.3		1.8	plant biomass	8(w)	1100 (EC10) (900-1330) 1183 (EC50) (1100-1250)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		6.3		1.8	grain yield	9(m)	622 (EC10) (207-1870) 1040 (EC50) (634-1710)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	6.3		1.9	plant biomass	21(d)	930 (EC10) (835-1035) 955 (EC20) (895-1015) 1000 (EC50) (960-1035)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		6.3		1.9	plant biomass	8(w)	40 (EC10) (11-136) 223 (EC50) (133-375)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		6.3		1.9	grain yield	9(m)	586 (EC10) (0.8-434000) 632 (EC50) (92-4310)	mg/kg	m	74	Warne et al. (2008a)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	6.7		1.8	plant biomass	21(d)	430 (EC10) (110-1650) 560 (EC20) (215-1470) 870 (EC50) (595-1275)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		7.3		1.4	plant biomass	8(w)	635 (EC10) (400-1010) 1154 (EC50) (905-1470)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		7.3		1.4	grain yield	9(m)	731 (EC10) (300-1780) 5705 (EC50) (640-51200)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	7.6		1.1	plant biomass	21(d)	945 (EC10) (505-1780) 1020 (EC20) (670-1670) 1280 (EC50) (1065-1530)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		7.6		1.1	plant biomass	8(w)	3.32 (EC10) (0.003-4130) 2070 (EC50) (234-18300)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		7.6		1.1	grain yield	9(m)	1133 (EC10) (261-4900) 1147 (EC50) (60-21700)	mg/kg	m	74	Warne et al. (2008a)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Magnoliophyta	wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	7.9		1.4	plant biomass	21(d)	3300 (EC10) (2700-6700) 4280 (EC20) (1800-6040) 6680 (EC50) (4800-9300)	mg/kg	m	74	Warne et al. (2008b)
Copper	Pteridophyta	fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	100-500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Pterido-phyta	fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	~500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Pterido-phyta	fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
Copper	Annelida	red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4	14	5.7	mortality	7(d) 14(d) 21(d)	382 (LC50) (317-461) 300 (LC50) (233-388) 299 (LC50) (226-397)	mg/kg	m	91	Vic NBRP Unpublished
		red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.4	18	1.3	mortality	7(d) 14(d) 21(d)	108 (LC50) (108-109) 108 (LC50) (108-109) 108 (LC50) (108-109)	mg/kg	m	91	NSW NBRP Unpublished
		red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.4	18	1.3	mortality	7(d) 14(d) 21(d)	258 (LC50) (244-271) 187 (LC50) (185-190) 179 (LC50) (174-184)	mg/kg	m	91	NSW NBRP Unpublished
		red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.6	6	2.6	mortality	7(d) 14(d) 21(d)	>4900 (LC50) 495 (LC50) (262-933) 495 (LC50) (179-1364)	mg/kg	m	91	WA NBRP Unpublished

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Copper	Annelida	red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.9	38	3.5	mortality	7(d) 14(d) 21(d)	836 (LC50) (822-850) 654 (LC50) (610-700) 625 (LC50) (578-677)	mg/kg	m	91	NSW NBRP Unpublished
		red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.9	38	3.5	mortality	7(d) 14(d) 21(d)	986 (LC50) (757-1286) 388 (LC50) (143-1040) 423 (LC50) (300-597)	mg/kg	m	91	NSW NBRP Unpublished
Copper	Arthro-poda	collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	growth	42(d)	150 (NOEC) 300 (LOEC)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	reproduc-tion	42(d)	209 (EC10) 696 (EC50)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	survival	42(d)	300 (NOEC) 1500 (LOEC)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	time to 1st young	42(d)	>1500 (NOEC)	mg/kg	n	76	Nursita et al. (2005)
Lead	Bacteria	nitrifying microbes	indigenous	static	soil		9	0.12		nitrification	28(d)	3150 (EC50) (3140-3190) 2590 (EC50) (2580-2610) 1960 (EC50) (1760-2380) 3880 (EC50) (3670-3900)	mg/kg	n	74	Rusk et al. (2004)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Lead	Magnolio-phyta	lettuce (*Lactuca sativa*)	seed	static	soil		4.7	0.06		dry weight	31(d)	4122 (EC50) (3041-5584) 2553 (EC50) (2065-3154)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		4.8	0.06		dry weight	31(d)	107 (EC50) (80-140) 98 (EC50) (72-133)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		5.1	0.31		dry weight	31(d)	659 (EC50) (493-881) 1965 (EC50) (1425-2709)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		6.5	0.55		dry weight	31(d)	3194 (EC50) (2590-3931) 1228 (EC50) (749-2012)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		7.8	0.12		dry weight	31(d)	960 (EC50) (668-1379) 1092 (EC50) (746-1597)	mg/kg	m	79	Stevens et al. (2003)
Lead	Pterido-phyta	fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Lead	Pterido-phyta	fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	~500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 frond	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Lead	Pterido-phyta	fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
Lead	Arthro-poda	collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	growth	42(d)	750 (NOEC) 1500 (LOEC)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	survival	42(d)	>3000 (NOEC)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	time to 1st young	42(d)	>3000 (NOEC)	mg/kg	n	76	Nursita et al. (2005)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Manganese	Magnolio-phyta	candelabra wattle (*Acacia holosericea*)	42 day old seedlings	semi-static	nutrient solution		5			shoot dry weight	70(d)	5.1 (EC10)	µM	m	61	Reichman et al. (2004)
		Narrow-leaved ironbark (*Eucalyptus crebra*)	42 day old seedlings	semi-static	nutrient solution		5			shoot dry weight	70(d)	5 (EC10)	µM	m	61	Reichman et al. (2004)
		River redgum (*Eucalyptus camaldulensis*)	42 day old seedlings	semi-static	nutrient solution		5			shoot dry weight	70(d)	330 (EC10)	µM	m	61	Reichman et al. (2004)
		Weeping teatree (*Melaleuca leucadendra*)	42 day old seedlings	semi-static	nutrient solution		5			shoot dry weight	70(d)	21 (EC10)	µM	m	61	Reichman et al. (2004)
		wheat (*Triticum aestivum*)	3 day old seedlings; roots 20 mm	static	0.2 mM solution $CaCl_2$	25	4.3			root length	48(h)	211 (EA25) (199-236) 680 (EA50) (613-809)	µM	m	81	Fortunati et al. (2005)
Nickel	Pterido-phyta	fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	~100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	50-100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	~50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Nickel	Pterido-phyta	fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	100-500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	100-500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	100-500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	100-500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Nickel	Pterido-phyta	fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
Selenium (IV)	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	moist filter paper	24	5.5			root length	2(d)	11 (EC10) 38 (EC50)	mg/L	n	52	Lyons et al. (2005)
Selenium (VI)	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	moist filter paper	24	5.5			root length	2(d)	15 (EC10)	mg/L	n	52	Lyons et al. (2005)
		wheat (*Triticum aestivum*)	pre-germinated seeds	static	Uni of California mix	13-23	5.5			shoot dry weight	30(d)	2 (NOEC) 4 (LOEC)	mg/kg	n	52	Lyons et al. (2005)
		wheat (*Triticum aestivum*)	pre-germinated seeds	static	Uni of California mix	10-18	5.5			shoot fresh wt	22(d)	2 (NOEC) 4 (LOEC)	mg/kg	n	52	Lyons et al. (2005)
		wheat (*Triticum aestivum*)	seed	static	soil		6.6	0.05		yield	NR	>120 (NOEC) >120 (NOEC)	g/ha	n	37	Lyons et al. (2005)
		wheat (*Triticum aestivum*)	seed	static	soil		8.6	0.11		yield	NR	>120 (NOEC) >120 (NOEC)	g/ha	n	37	Lyons et al. (2005)
Zinc	Bacteria	nitrifying microbes	indigenous	static	soil	20	4		5.6	nitrification	28(d)	10 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	4.4		1.2	nitrification	28(d)	70 (EC10)	mg/kg	m	81	Broos et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Bacteria	nitrifying microbes	indigenous	static	soil	20	4.5		1.4	nitrification	28(d)	63 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	4.8		2.6	nitrification	28(d)	188 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	4.9		2	nitrification	28(d)	346 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	5		1.8	nitrification	28(d)	270 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	5.1		3.4	nitrification	28(d)	901 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	5.4		0.9	nitrification	28(d)	209 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	6.3		1.9	nitrification	28(d)	919 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	6.3		1.8	nitrification	28(d)	462 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	7.3		1.3	nitrification	28(d)	1181 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil	20	7.6		1.2	nitrification	28(d)	7538 (EC10)	mg/kg	m	81	Broos et al. (2007)
		nitrifying microbes	indigenous	static	soil		9	0.12		nitrification	28(d)	850 (EC50) (850-870)	mg/kg	n	74	Rusk et al. (2004)
		nitrifying microbes	indigenous	static	soil		9	0.12		nitrification	28(d)	350 (EC50) (270-420)	mg/kg	n	74	Rusk et al. (2004)
		nitrifying microbes	indigenous	static	soil		9	0.12		nitrification	28(d)	>1000 (EC50)	mg/kg	n	74	Rusk et al. (2004)
		nitrifying microbes	indigenous	static	soil		9	0.12		nitrification	28(d)	230 (EC50) (160-300)	mg/kg	n	74	Rusk et al. (2004)
		nitrifying microbes	indigenous	static	soil		9	0.12		nitrification	28(d)	650 (EC50) (600-690)	mg/kg	n	74	Rusk et al. (2004)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Bacteria	nitrifying microbes	indigenous	static	soil		9	0.12		nitrification	28(d)	210 (EC50) (180-240)	mg/kg	n	74	Rusk et al. (2004)
		soil microbes	indigenous	static	soil	20	4.4		1.2	respiration rate	6(h)	73 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	4.5		1.4	respiration rate	6(h)	369 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	4.8		2.6	respiration rate	6(h)	345 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	4.9		2	respiration rate	6(h)	462 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	5		1.8	respiration rate	6(h)	499 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	5.1		3.4	respiration rate	6(h)	281 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	5.4		0.9	respiration rate	6(h)	158 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	6.3		1.9	respiration rate	6(h)	25 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	6.3		1.8	respiration rate	6(h)	268 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	7.3		1.3	respiration rate	6(h)	187 (EC10)	mg/kg	m	81	Broos et al. (2007)
		soil microbes	indigenous	static	soil	20	7.6		1.2	respiration rate	6(h)	190 (EC10)	mg/kg	m	81	Broos et al. (2007)
Zinc	Magnolio-phyta	barley (*Hordeum vulgare*)	seed	static	soil		6.3	7	1.9	yield	9(m)	490.5 (EC10)	mg/kg	m	74	SA NBRP Unpublished
		barley (*Hordeum vulgare*)	seed	static	soil		6.7	20	1.8	yield	9(m)	486.7 (EC10)	mg/kg	m	74	SA NBRP Unpublished

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Magnolio-phyta	barley (*Hordeum vulgare*)	seed	static	soil		7.6	11	1.1	yield	9(m)	56.4 (EC10)	mg/kg	m	74	SA NBRP Unpublished
		candelabra wattle (*Acacia holosericea*)	42 day old seedlings	static	nutrient solution	20-45	5			biomass	70(d)	12 (EC10) ~50 (EC50)	µM	m	62	Reichman et al. (2001)
		Colza (*Brassica napus*)	seed	static	soil		4.6	6	2.6	yield	9(m)	52.3 (EC10)	mg/kg	m	74	WA NBRP Unpublished
		Colza (*Brassica napus*)	seed	static	soil		5	7	2	yield	9(m)	144.6 (EC10)	mg/kg	m	74	Vic NBRP Unpublished
		Colza (*Brassica napus*)	seed	static	soil		5.6	6	0.9	yield	9(m)	139.1 (EC10)	mg/kg	m	74	WA NBRP Unpublished
		Colza (*Brassica napus*)	seed	static	soil		6.7	20	1.8	yield	9(m)	178.8 (EC10)	mg/kg	m	74	SA NBRP Unpublished
		Corn (*Zea mays*)	seed	static	soil		5.4	6	1.8	yield	9(m)	500.5 (EC10)	mg/kg	m	74	QLD NBRP Unpublished
		Cotton (*Gossypium* sp.)	seed	static	soil		7.9	10	1.4	yield	9(m)	2128 (EC10)	mg/kg	m	74	QLD NBRP Unpublished
		lettuce (*Lactuca sativa*)	seed	static	soil		4.7	0.06		dry weight	31(d)	2 (EC50) (0.54-4.83) 4 (EC50) (1.04-15.1)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		4.7	0.06		dry weight	31(d)	276 (EC50) (131-575) 94 (EC50) (46-190)	mg/kg	m	79	Stevens et al. (2003)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Magnolio-phyta	lettuce (*Lactuca sativa*)	seed	static	soil		4.8	0.06		dry weight	31(d)	3 (EC50) (2.5-3.8) 10 (EC50) (7.5-14)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		5.1	0.31		dry weight	31(d)	274 (EC50) (188-399) 75 (EC50) (48-115)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		5.1	0.31		dry weight	31(d)	5 (EC50) (2.74-7.69) 7 (EC50) (4.49-9.77)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		6.5	0.55		dry weight	31(d)	4 (EC50) (1.81-8.33) 8 (EC50) (4.52-15.4)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		6.5	0.55		dry weight	31(d)	289 (EC50) (144-578) 328 (EC50) (154-696)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		7.8	0.12		dry weight	31(d)	8 (EC50) (6.47-8.75) 11 (EC50) (9.33-14.1)	mg/kg	m	79	Stevens et al. (2003)
		lettuce (*Lactuca sativa*)	seed	static	soil		7.8	0.12		dry weight	31(d)	383 (EC50) (344-425) 266 (EC50) (248-283)	mg/kg	m	79	Stevens et al. (2003)
		peanut (*Arachis hypogaea*)	seed	static	soil		5.4	6	1.8	yield	9(m)	227.1 (EC10)	mg/kg	m	74	QLD NBRP Unpublished
		peanut (*Arachis hypogaea*)	seed	static	soil		4.5	6	1.4	yield	9(m)	16.3 (EC10)	mg/kg	m	74	QLD NBRP Unpublished

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Magnoliophyta	proso millet (*Panicum miliaceum*)	seed	static	soil		5.4	6	1.8	yield	9(m)	419.1 (EC10)	mg/kg	m	74	QLD NBRP Unpublished
		river redgum (*Eucalyptus camaldulensis*)	42 day old seedlings	static	nutrient solution	20-45	5			biomass	70(d)	20 (EC10) ~50 (EC50)	µM	m	62	Reichman et al. (2001)
		sorghum (*Sorghum* sp.)	seed	static	soil		7.9	10	1.4	yield	9(m)	1661 (EC10)	mg/kg	m	74	QLD NBRP Unpublished
		sugarcane (*Saccharum* sp.)	seed	static	soil		4.5	6	1.4	yield	9(m)	780 (EC10)	mg/kg	m	74	QLD NBRP Unpublished
		triticale (*Tritosecale* sp.)	seed	static	soil		4	14	5.7	yield	9(m)	310.2 (EC10)	mg/kg	m	74	Vic NBRP Unpublished
		Weeping teatree (*Melaleuca leucadendra*)	42 day old seedlings	static	nutrient solution	20-45	5			biomass	70(d)	1.5 (EC10) ~25 (EC50)	µM	m	62	Reichman et al. (2001)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4		5.7	plant biomass	21(d)	875 (EC10) (550-1390) 1000 (EC20) (700-1420) 1265 (EC50) (1050-1520)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		4		5.6	grain yield	9(m)	255 (EC10) (50-1280) 702 (EC50) (236-2100)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4.4		1.3	plant biomass	21(d)	250 (EC10) (160-385) 400 (EC20) (290-550) 890 (EC50) (730-1090)	mg/kg	m	74	Warne et al. (2008b)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Magnoliophyta	wheat (*Triticum aestivum*)	seed	static	soil		4.4		1.2	plant biomass	8(w)	45 (EC10) (8.5-240) 182 (EC50) (75-445)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		4.4		1.2	grain yield	9(m)	374 (EC10) (111-1260) 632 (EC50) (330-1200)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4.5		1.4	plant biomass	21(d)	235 (EC10) (145-370) 300 (EC20) (215-425) 470 (EC50) (390-570)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4.6		2.6	plant biomass	21(d)	335 (EC10) (275-405) 460 (EC20) (400-530)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4.6		2.6	plant biomass	21(d)	790 (EC50) (715-880)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		4.8		2.6	plant biomass	8(w)	52 (EC10) (19-143) 159 (EC50) (110-229)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		4.8		2.6	grain yield	9(m)	102 (EC10) (39-268) 363 (EC50) (220-600)	mg/kg	m	74	Warne et al. (2008a)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	4.9		3.5	plant biomass	21(d)	530 (EC10) (275-1030) 825 (EC20) (510-1335) 1745 (EC50) (1340-2266)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		4.9		2.0	grain yield	9(m)	428 (EC10) (205-900) 833 (EC50) (555-1250)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	5		2	plant biomass	21(d)	965 (EC10) (730-1280) 1110 (EC20) (895-1380) 1410 (EC50) (1255-1590)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	5			plant biomass	21(d)	565 (EC10) (380-830) 710 (EC20) (527-950) 1050 (EC50) (840-1300)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		5		1.8	plant biomass	8(w)	244 (EC10) (163-366) 377 (EC50) (307-463)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		5		1.8	grain yield	9(m)	262 (EC10) (15-655) 389 (EC50) (246-615)	mg/kg	m	74	Warne et al. (2008a)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Magnoliophyta	wheat (*Triticum aestivum*)	seed	static	soil		5.1		3.4	plant biomass	8(w)	640 (EC10) (370-1110) 1120 (EC50) (795-1580)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		5.1		3.4	grain yield	9(m)	1312 (EC10) 1320 (EC50)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	5.4		1.8	plant biomass	21(d)	505 (EC10) (110-2250) 685 (EC20) (230-2040) 1160 (EC50) (700-1900)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		5.4		0.9	plant biomass	8(w)	161 (EC10) (54-490) 270 (EC50) (207-354)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		5.4		0.9	grain yield	9(m)	91 (EC10) (16-515) 263 (EC50) (170-410)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	5.6		0.9	plant biomass	21(d)	275 (EC10) (190-390) 275 (EC20) (195-385) 590 (EC50) (455-765)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	6		2.9	plant biomass	21(d)	655 (EC10) (225-1910) 880 (EC20) (400-1950) 1460 (EC50) (830-2570)	mg/kg	m	74	Warne et al. (2008b)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	6.3		1.9	plant biomass	21(d)	620 (EC10) (400-950) 860 (EC20) (620-1190) 1500 (EC50) (1225-1840)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		6.3		1.8	plant biomass	8(w)	1210 (EC10) (390-3750) 2123 (EC50) (865-5220)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		6.3		1.8	grain yield	9(m)	670 (EC10) (95-5000) 1350 (EC50) (515-3500)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		6.3		1.9	plant biomass	8(w)	657 (EC10) (267-1615) 1875 (EC50) (1180-2990)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		6.3		1.9	grain yield	9(m)	1217 (EC10) (626-2360) 1780 (EC50) (1100-2780)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	6.7		1.8	plant biomass	21(d)	430 (EC10) (230-820) 615 (EC20) (390-980) 1135 (EC50) (875-1475)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		7.3		1.4	plant biomass	8(w)	2765 (EC10) (540-14200) 3900 (EC50) (137-108000)	mg/kg	m	74	Warne et al. (2008a)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Magnolio-phyta	wheat (*Triticum aestivum*)	seed	static	soil		7.3		1.4	grain yield	9(m)	2351 (EC10) (1520-3600) 4560 (EC50) (1120-18600)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	7.6		1.1	plant biomass	21(d)	755 (EC10) (380-1500) 980 (EC20) (595-1610) 1530 (EC50) (1200-1950)	mg/kg	m	74	Warne et al. (2008b)
		wheat (*Triticum aestivum*)	seed	static	soil		7.6		1.1	plant biomass	8(w)	17.2 (EC10) (0.04-7580) 12900 (EC50) (1000-170000)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil		7.6		1.1	grain yield	9(m)	4760 (EC10) 4789 (EC50)	mg/kg	m	74	Warne et al. (2008a)
		wheat (*Triticum aestivum*)	seed	static	soil	20 day; 15 night	7.9		1.5	plant biomass	21(d)	5855 (EC10) (4835-7090) 6140 (EC20) (5700-6620) 6670 (EC50) (5770-7710)	mg/kg	m	74	Warne et al. (2008b)
Zinc	Pterido-phyta	fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Adiantum aethiopicum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Pterido-phyta	fern (*Blechnum cartilagineum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	~100 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Blechnum nudum*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Calochlaena dubia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	~500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Dennstaedtia davakkioides*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	~500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Doodia aspera*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Hypolepis muelleri*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Pterido-phyta	fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Nephrolepis cordifolia*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	<50 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pellaea falcata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					frond dry wt	20(w)	>500 (EC50)	mg/kg	n	48	Kachenko et al. (2007)
		fern (*Pteris vittata*)	3-4 months with 3-4 fronds	static	Debco potting mix with 10% perlite					root dry wt	20(w)	>500 (EC50	mg/kg	n	48	Kachenko et al. (2007)
Zinc	Annelida	red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4	14	5.7	mortality	7(d) 14(d) 21(d)	373 (LC50) (367-380) 370 (LC50) (359-382) 351 (LC50)	mg/kg	m	91	Vic NBRP Unpublished
		red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.4	18	1.3	mortality	7(d) 14(d) 21(d)	530 (LC50) (519-542) 472 (LC50) (463-481) 473 (LC50) (460-487)	mg/kg	m	91	NSW NBRP Unpublished
		red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.4	18	1.3	mortality	7(d) 14(d) 21(d)	263 (LC50) 263 (LC50) 263 (LC50)	mg/kg	m	91	NSW NBRP Unpublished

Metal	Division/ phylum	Species	Life Stage	Mode of Exposure	Test medium	Temp (°C)	pH	EC (µS/cm)	Organic Carbon (%)	Endpoint	Duration	Toxic conc & measure of toxicity	Units of toxic conc[a]	Conc type[b]	Quality score	Reference
Zinc	Annelida	red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.6	6	2.6	mortality	7(d) 14(d) 21(d)	863 (LC50) (592-1259) 831 (LC50) (487-1420) 832 (LC50) (473-1462)	mg/kg	m	91	WA NBRP Unpublished
		red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.9	38	3.5	mortality	7(d) 14(d) 21(d)	1490 (LC50) (1370-1625) 1410 (LC50) (1342-1480) 1380 (LC50) (1242-1525)	mg/kg	m	91	NSW NBRP Unpublished
		red earthworm (*Eisenia andrei*)	adults 300-600 mg	static	soil	20±2	4.9	38	3.5	mortality	7(d) 14(d) 21(d)	852 (LC50) (720-1010) 852 (LC50) (720-1010) 852 (LC50) (720-1010)	mg/kg	m	91	NSW NBRP Unpublished
Zinc	Arthropoda	collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	growth	42(d)	<200 (NOEC) 200 (LOEC)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	time to 1st young	42(d)	1000 (NOEC) 2000 (LOEC)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	reproduction	42(d)	61 (EC10) 283 (EC50)	mg/kg	n	76	Nursita et al. (2005)
		collembola (*Proisotoma minuta*)	adults	static	acid sandy loam	20±1	4.9	110.6	1.32	Survival	42(d)	1000 (NOEC) 2000 (LOEC)	mg/kg	n	76	Nursita et al. (2005)

[a] the concentration is always expressed as a mass of the metal per unit volume of the aqueous solution (for the hydroponically grown plants) or as a mass of the metal per unit mass of the soil or other solid growth medium unless otherwise stated. [b] m = measured concentration, n = nominal (not measured) concentration, NR = not recorded.

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