European Union Risk Assessment Report

NICKEL AND NICKEL COMPOUNDS

Nickel

CAS-No.: 7440-02-0

EINECS-No.: 231-111-4

Nickel Sulphate

CAS-No.: 7786-81-4

EINECS-No.: 232-104-9

Nickel Carbonate

CAS-No.: 3333-67-3

EINECS-No.: 222-068-2

Nickel Chloride

CAS-No.: 7718-54-9

EINECS-No.: 231-743-0

Nickel Dinitrate

CAS-No.: 13138-45-9

EINECS-No.: 236-068-5

CAS No: 7440-02-0

EINECS No: 231-111-4

(SECTION 6)

References

RISK ASSESSMENT

LEGAL NOTICE

Neither the European Commission nor any person
acting on behalf of the Commission is responsible for the use which might
be made of the following information

A great deal of additional information on the European Union
is available on the Internet.
It can be accessed through the Europa Server
(http://europa.eu.int).

Cataloguing data can be found at the end of this publication

Luxembourg: Office for Official Publications of the European Communities, [ECB:
year]
ISBN [ECB: insert number here]

Printed in Italy

NICKEL

CAS No: 7440-02-0

EINECS No: 231-111-4

RISK ASSESSMENT

Final Version
30 May, 2008

Denmark

Rapporteur for the risk assessment of Nickel is Denmark

Contact point:

Henrik Tyle, Danish Environmental Protection Agency, Strandgade 29, 1401 København K, Denmark, Email: hty@mst.dk

Assisted by Janeck Scott-Fordsmand, Department of Terrestrial Ecology, National Environmental Research Institute ,University of Aarhus, P.O. Box 314, Vejlsoevej 25, DK-8600 Silkeborg, Denmark

Date of Last Literature Search : **[insert year]**
Review of report by MS Technical Experts finalised: **[insert month and year]**
Final report: **[insert year]**

Foreword

This Draft Risk assessment Report is carried out in accordance with Council Regulation (EEC) 793/93[1] on the evaluation and control of the risks of "existing" substances. "Existing" substances are chemical substances in use within the European Community before September 1981 and listed in the European Inventory of Existing Commercial Chemical Substances. Regulation 793/93 provides a systematic framework for the evaluation of the risks to human health and the environment of these substances if they are produced or imported into the Community in volumes above 10 tonnes per year.

There are four overall stages in the Regulation for reducing the risks: data collection, priority setting, risk assessment and risk reduction. Data provided by Industry are used by Member States and the Commission services to determine the priority of the substances which need to be assessed. For each substance on a priority list, a Member State volunteers to act as "Rapporteur", undertaking the in-depth Risk Assessment and recommending a strategy to limit the risks of exposure to the substance, if necessary.

The methods for carrying out an in-depth Risk Assessment at Community level are laid down in Commission Regulation (EC) 1488/94[2], which is supported by a technical guidance document[3]. Normally, the "Rapporteur" and individual companies producing, importing and/or using the chemicals work closely together to develop a draft Risk Assessment Report, which is then presented at a Meeting of Member State technical experts for endorsement. The Risk Assessment Report is then peer-reviewed by the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) which gives its opinion to the European Commission on the quality of the risk assessment.

This Draft Risk Assessment Report is currently under discussion in the Competent Group of Member State experts with the aim of reaching consensus. During the course of these discussions, the scientific interpretation of the underlying scientific information may change, more information may be included and even the conclusions reached in this draft may change. The Competent Group of Member State experts seek as wide a distribution of these drafts as possible, in order to assure as complete and accurate an information basis as possible. The information contained in this Draft Risk Assessment Report does not, therefore, necessarily provide a sufficient basis for decision making regarding the hazards, exposures or the risks associated with the priority substance.

This Draft Risk Assessment Report is the responsibility of the Member State rapporteur. In order to avoid possible misinterpretations or misuse of the findings in this draft, anyone wishing to cite or quote this report is advised to contact the Member State rapporteur beforehand.

Contact Details of the Rapporteur(s)

[1] O.J. No L 084, 05/04/199 p.0001 – 0075

[2] O.J. No L 161, 29/06/1994 p. 0003 – 0011

[3] Technical Guidance Document, Part I – V, ISBN 92-827-801 [1234]

0 OVERALL RESULTS OF THE RISK ASSESSMENT[4]

[Note: In the final report, chapters 0 and 5 should be as close as possible to the OJ]

CAS Number: [click here to insert CAS No.]
EINECS Number: [click here to insert EINECS No.]
IUPAC Name: [click here to insert IUPAC name]

Environment

(X)	**Conclusion (i)**	There is a need for further information and/or testing.
(X)	**Conclusion (ii)**	There is at present no need for further information and/or testing and no need for risk reduction measures beyond those which are being applied already.
(X)	**Conclusion (iii)**	There is a need for limiting the risks; risk reduction measures which are already being applied shall be taken into account.

Conclusion (i) is reached because:

- There is a need for additional testing to provide robust data for the derivation of the PNECsediment.

Conclusion (ii) is reached because:

- The risk assessment has shown that exposure of nickel at the regional scale results in no risk for most scenarios in the aquatic and terrestrial compartments. Additionally, no regional risk was shown for secondary poisoning.

Conclusion (iii) is reached because:

- The risk assessment has shown that exposure of nickel at the regional scale causes potential risk to aquatic organisms in waters with high pH and low Dissolved Organic Carbon. Also, subsets of soils from Spain and the UK show potential risk. Several instances of risk to the aquatic and terrestrial compartments were observed for specific sites in the Local Scale risk characterization.

[4] Conclusion (i) There is a need for further information and/or testing.
Conclusion (ii) There is at present no need for further information and/or testing and no need for risk reduction measures beyond those which are being applied already.
Conclusion (iii) There is a need for limiting the risks; risk reduction measures which are already being applied shall be taken into account.

NOTE: THIS TEXT IS DRAFT AND IS SUBJECT TO REVISION. THESE CONCLUSIONS SHOULD NOT BE CONSIDERED FINAL UNTIL AFTER MAY 30TH 2008.

CONTENTS

6 REFERENCES

6.1 REFERENCES, SECTION 3.1

6.1.1 References, Section 3.1, Main Body

Anderson P.R. & Christensen T.H., 1988. Distribution coefficients of Cd, Co, Ni and Zn in soils. Journal of Soil Science, 39, pp. 15-22.

Antil, R.S., A. P. Gupta and R.P. Narwal, 1993. Effect of substrate concentration, soil moisture and iorganic amendments on urease activity of soil containing variable Nickel amounts. Arid Soil Research and Rehabilitation (7) : 381-387.

Atanassova I (1999): Competitive effect of copper, zinc, cadmium and nickel on ion adsorption and desorption by soil clays. Water Air and Soil Pollution 113(1/4): 115-125.

Antoniadis and Alloway 2002. (Leaching of cadmium, nickel and zinc down the profile of sewage sludge-treated soil Commun.soil. sci. plant anal.,33 (1&2) 273-286).

Barrett, M.E., R.D. Zuber et al., 1995. A review and evaluation of literature pertaining to the quantity and control pollution from highway runoff and construction. Centre for Research in Water Resources. Online Report 95-5.

Bentum, F. van; et al., 1996. Doelgroepstudie Wegverkeer. Verslag van de beleidsanalyse voor de doelgroep wegverkeer. Watersysteemverkenningen. RIZA nota nr. 96.053.

Berbee et al., R.P.M., 1996. Behandeling van afstromend wegwater van snelwegen. RIZA nota nr. 96.017.

Blok, J., 2003. Data review and exposure scenario for zinc at road borders (International Zinc Association Europe).

Bockting GJM, van de Plassche EJ, Struijs J, Canton JH (1992): Soil-water partition coefficients for some trace metals. RIVM report no. 679101003. Nationl Institute of Public Health and Environmental Protection, Bilthoven, The Netherlands.

Bubb JM and Lester JN (1991): The impact of heavy metals on lowland rivers and the implications for man and the environment. Sci. Total Environ. 100: 207-233.

Buchter B, Davidoff B, Amacher MC, Hinz C, Iskandar IK, Selim HM (1989) Correlation of Freundlich Kd and n retention parameters with soils and elements. Soil Science 148: 370-379.

CBS (2002): Waterkwaliteitsbeheer, Zuivering van afvalwater. CBS, Voorburg/Heerlen, Nederland.

CBS (2004): Waterkwaliteitsbeheer, Zuivering van afvalwater. CBS, Voorburg/Heerlen, Nederland.

Chau Y K and Kulikovsky-Cordeiro OTR (1995): Occurrence of nickel in the Canadian environment. Environmental Reviews 3:95-120.

Civici, N., 1995. Determination of Vanadium and Nickel in oil, Asphaltene and Bitumen using thin-film energy-dispersive X-Ray Fluorescence specteometry. X-Ray spectrometry, Vol 24, 163-166.

Comber SDW and Gunn AM (1992): Mesocosm studies of contaminants in sewage sludge. Report to the DoE, No. DoE 2849/1. WRc, Henley Road, Medmenham, Marlow, UK.

Comber SDW and Gunn AM (1994): Diffuse sources of heavy metals to sewers. Final report to the DoE, No. DoE 3624 reference no. PECD 7/7/406.

Comber SDW, Gardner MJ, Gunn AM, Whalley C (1996) Kinetics of Trace Metal Sorption to Estuarine Suspended Particulate Matter. Chemosphere, 33(6), 1027-1040.

Concawe, 1999. Emission Inventory Guidebook. Road Transport. Rt070100.

Comber SDW, Gunn AM, Whalley C (1995) Comparison of the Partitioning of Trace Metals in the Humber and Mersey Estuaries. Mar. Pollut. Bull. 30(12), 851-860.

Crommentuijn T, Polder MD, van de Plassche EJ (1997): Maximum Permissible Concentrations and Negligible Concentrations for metals, taking background concentrations into account. RIVM Report No. 601501 001. National Institute of Public Health and Environmental Protection, Bilthoven, The Netherlands.

Dannecker et al., 1990. Substance load in rainwater runoff from different streets in Hamburg. The Science of the total Environment 93: 385 –392.

Davis A.P. *et.al.*, 2001. Loading estimates of nickel, copper, cadmium, and zinc in urban runoff from specific sources. Chemosphere 44: p. 997-1009.

De Groot AC, Peijnenburg WJGM, van den Hoop MAGT, Ritsema R, van Veen RPM (1998): Heavy metals in Dutch field soils: an experimental and theoretical study on equilibrium partitioning. RIVM report no. 607220001. National Institute of Public Health and the Environment (RIVM). Bilthoven, the Netherlands

Denkhaus, E. and K. Salnikow, 2002. Nickel essentially, toxicity and carcinogenity. Critical Reviews in Oncology/Hematology 42 (2002) 35-56.

DEPA (2000): Punktkilder 1999. Det nationale program for overvågning af vandmiljøet, Fagdatacenterrapport. Orientering Nr. 16. Miljøstyrelsen. (In Danish: Point sources. The national programme on survey of the water environment.) Danish Environmental Protection Agency, Copenhagen.

DEPA (2002): Punktkilder 2001. Det nationale program for overvågning af vandmiljøet, Fagdatacenterrapport. Orientering Nr. 7. Miljøstyrelsen. (In Danish: Point sources. The national programme on survey of the water environment.) Danish Environmental Protection Agency, Copenhagen.

Danish Environmental Protection Agency, 2003. Nickel Risk Assessment. Environment Exposure (section 3.1). Draft of September 2003.

DBW/RIZA (1989): Kansen voor waterorganismen. Ministerie van Verkeer en Waterstaat. DBW/RIZA, Lelystad.

ECOLAS, 2003. Assessment of point and diffuse sources of lead(compounds) and copper(compounds) as a basis for regional and continental exposure assessment. Unpublished.

ECOLAS, 2003. Review of point and diffuse sources of nickel in Europe. Final report. July 2003.

Edelman, Th. 1983. Achtergrondgehalten van stoffen in de bodem. RIN, Arnhem.

EHC, 1991. Environmental Health Criteria 108 Nickel. International Programme on chemical safety UNEP and WHO.

Eisler R (1998): Nickel hazards to fish, wildlife and invertebrates: A synoptic review. Contaminant Hazard Reviews Report 34. Biological Science Report USGS/BRD/BSR 1998-0001. U.S. Geological Survey. (NTIS Technical Report NTIS/ADA361155).

Elbaz-Poulichet F, Garnier J-M, Guan DM, Martin J-M, Thomas AJ (1996): The conservative behaviour of trace metals (Cd, Cu, Ni and Pb) and As in the surface plume of stratified estuaries: example of the Rhöne River (France). Estuar.Coast.Shelf Sci. 42, 289-310.

ELSIA, 2002. Unpublished data.

Entec UK Ltd., 2001. Economic Evaluation of Air Quality Targets for Heavy Metals. In Assignment of the European Commission.

EURAS, 2003. Probabilistic distribution of Nickel in European Surface Waters. Final report, November 2004.

EURAS, ECOLAS, 2005. Regional exposure assessment Ni metal and Ni compounds . PEC derivation (EUSES). Draft of December 2004. Study for NiPERA.

European Commission, 2001. Pollutants in urban wastewater and sewage sludge. Final report prepared by ICON (IC Consultants, London) for the Directorate-General Environment.

European Communities (EC), 2003. Technical Guidance Document on Risk Assessment in support of Commission Directive 93/67/EEC on Risk Assessment for new notified substances, Commission Regulation (EC) No 1488/94 on Risk Assessment for existing substances and Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market. Part II: Environment. Office for Official Publications of the European Communities, Luxembourg.

EC (2004): European Union System for the Evaluation of Substances 2.0 (EUSES 2.0). Prepared for the European Chemicals Bureau by the National Institute of Public Health and the Environment (RIVM), Bilthoven, the Netherlands. Available via the European Chemicals Bureau, http://ecb.jrc.it.

Feenstra, J.F.; and P.F.J. van der Most, 1986. Diffuse bronnen van waterverontreinigingen. CUWVO VI, RIZA, Lelystad.

Gish C.D. and R.E. Christensen, 1973. Cadmium, Nickel, Lead and Zinc in Earthworms from Roadside soil. Environmental Science & Technology (7)11:1060-1062.

Gould MS, and Genetelli EJ (1982): Effect of temperature on heavy metal binding by anaerobically digested sludges. Water Research 16: 749-753.

Groot, M.S.M.; and E.C. van Swinderen, 1993. Study on the quality of soil and groundwater along roads in woody areas. RIVM report 714822001.

Gunn AM, Rogers HRR, Comber SDW (1992): Investigation of partitioning of of contaminants between water and sediment. National Rivers Authority Project record 016/8/N WRc plc, Henley Road, Medmenham, Marlow, UK.

Haskoning, 2002. Nickel fact sheet. Fact sheets on production, use and release of priority substances in the WFD, Draft 2.

Haskoning, 2003. Data review for the exposure of soil at road borders to nickel. Prepared for NiPERA by RoyalHaksoning, May 2003.

Haskoning, 2005. Data review for the exposure of soil at road borders to nickel. Erratum and addendum to the report. By J. Blok 18/7/2005.

Heijerick D, Van Sprang P (2004): Review of nickel partitioning coefficients in the aquatic environment and processes causing the observed variation. EURAS, Draft final report prepared for NiPERA, November 2004.

Heijerick D, Van Sprang P (2004): Probabilistic distribution of nickel in surface waters. EURAS, Final report prepared for NiPERA, November 2004.

Heijerick D, Van Sprang P (2004): Probabilistic distribution of nickel in European freshwater sediments. EURAS, Final report prepared for NiPERA, November 2004.

Heijerick D, Van Sprang P (2004): Data analysis and PEC derivation of nickel concentrations in Europeans soils. EURAS, Final report prepared for NiPERA, November 2004.

International Nickel Study Group (INSG), 2002. World nickel statistics. Current statistics: 2000/2001. http://www.insg.org/curstats.htm

Janssen RPT, Pretorius PJ, Peijnenburg WJGM, Hoop MAGT van den (1996): Determination of field-based partition coefficients for heavy metals in Dutch soils and the relationships of these coefficients with soil characteristics. RIVM report no. 719101023. National Institute of Public Health and the Environment (RIVM). Bilthoven, the Netherlands.

Janssen R., Peijnenburg W. and van den Hoop M. (1997): Equilibrium partitioning of heavy metals in Dutch soils. I. Relationships between metal partition coefficients and soil characteristics. Environ. Toxicol. Chem., Vol. 16: 2470-2478.

Kern U, Li CC, Westrich B (1998): Assessment of sediment contamination from pollutant discharge in surface waters. Water Science & Technology 37(6/7): 1-8.

King LD (1988): Retention of metals by several soils of the Southeastern United States. J. Environ. Qual. 17(2): 239-250

Koelmans AA, Radovanovic H (1998): Prediction of trace metal distribution coefficients (KD) for aerobic sediments. Water Sci.Technol. 37: 71-78.

Lofts S, Tipping E (2000): Solid-solution metal partitioning in the Humber rivers: application of WHAM and SCAMP. Sci.Total Environ. 251-252: 381-399.

Martin HW, Kaplan DI (1998) : Water Air Soil Pollution 101 : 399-410.

McNear, D.H., Jr., R.L. Chaney, and D.L. Sparks. (2007) The effects of soil type and chemical treatment on nickel speciation in refinery enriched soils: A multi-technique investigation. Geochimica et Cosmochimica Acta 71: 2190–2208.

Moriyama K, Mori T, Arayashiki H, Saito H, Chino M (1989): The amount of heavy metals derived from domestic wastewater. Water Sci. Technol. 21: 1913-1916.

Neal C, Robson AJ, Jeffrey HA (1997): Trace element inter-relationships for the Humber rivers: interferences for hydrological and chemical controls. Sci.Total Environ. 194/195: 321-343.

Nickel industry, 2001/2002. Nickel local environmental exposure questionnaires.

NiPERA, 2001. Nickel Environmental Releases and Exposure Data for Denmark.

NiPERA, 2002. Nickel Environmental Releases and Exposure Data for Sweden.

NiPERA, 2003a. Nickel Environmental Releases and Exposure Data for Finland.

NiPERA, 2003b. Nickel Environmental Releases and Exposure Data for the United Kingdom. Dames and Moore, UK on behalf of the Nickel Producers Environmental Research Association (NiPERA).

NiPERA, 2003c. Nickel Environmental Releases and Exposure Data for Spain.

NiPERA, 2003d. Nickel Environmental Releases and Exposure Data for Germany. Dames and Moore, UK on behalf of the Nickel Producers Environmental Research Association (NiPERA).

NiPERA, 2003e. Nickel Environmental Releases and Exposure Data for France.

NiPERA, 2003f. Nickel Environmental Releases and Exposure Data for Greece.

Olajire, A.A., and E.T. Ayodele, 1996. Contamination of roadside soil and grass with heavy metals. Environmental International. Vol. 23. No. 1. pp. 91-101 (1997).

Oldenkamp, A. and F.H.M. van de Ven, 1987. Kwaliteit van de afgevoerde neerslag van een hoofdweg in Lelystad. H_2O volume 20, afl. 7.

Oostergo, H.D., 1993. Oriënterende studie naar de emissies van zware metalen, PAK, asbest en olie door het wegverkeer. Rapportnr. W-DWW-93-711. DWW, Delft.

Pettine M, Camusso M, Martinotti W, Marchetti R, Passino R, Queirazza G (1994): Soluble and particulate metals in the Po River: factors affecting concentrations and partitioning. Sci.Total Environ. 145: 243-265.

Popp CJ and Laquer F (1980): Trace metal transport and partitioning in the suspended sediments of the Rio Grande and tributuaries in central New Mexico. Chemosphere 9: 89-98.

RIVM, VROM, VWS (1999): Uniform system for the Evaluation of Substances 3.0 (USES 3.0). National Institute of Public Health and the Environment (RIVM), Ministry of Housing, Spatial planning and the Environment (VROM), Ministry of Health, Welfare and Sports (WVS), the Netherlands. RIVM report 601450 004.

Rogers H, Hurst K, Gardner M, Davis R (2002): Review of pollution inventory substances in sludges from sewage treatment works. WRc plc, R&D Technical Report No XXXX for Environment Agency, UK.

Sartor, J.D. and G. B. Boyd, 1972. Water Pollution Aspects of street surface contaminants. EPA-R2-02-081, November 1972. Prepared for Office of Research and monitoring U.S. Environmental Protection Agency Washington, D.C. 20460.

Sauvé S, Hendershot W, Allen HA (2000): Solid-solution partitioning of metals in contaminated soils: dependence on pH, total metal burden and organic matter. Environ. Sci. Technol. 34(7): 1125-1131.

Scott-Fordsmand et al., 1999. Ecotoxicology and Environmental Safety 43, 57-61.

Scott-Fordsmand, Janeck J. et al., 1999. Toxicity of nickel to a soil-dwelling Springtail. Ecotoxicology and Environmental Safety 43, 57-61 (1999).

Scott-Fordsmand, Janeck J., 1997. Toxicity of Nickel to Soil Organisms in Denmark. Reviews of Environmental Contamination and Toxicology, Vol. 148.

Shafer MM, Overdier JT, Armstrong DE (1998): Removal, partitioning, and fate of silver and other metals in wastewater treatment plants and effluent-receiving streams. Environ. Toxicol. Chem. 17(4): 630-641.

Sheppard MI, Thibault DH (1990): Health Phys. 59; 471-482.

Singh, B. R and A. S. Jeng, 1993. Uptake of zinc, cadmium, mercury, lead, chromium and nickel by ryegrass grown in a sandy soil Norwegian Journal of agricultural sciences 7 (2); 147 – 157.

Stortelder PBM, Van der Gaag, MA, Van der Kooy LA (1989): Perspectives for water organisms (part 1 and 2). DBW/RIZA Nota No. 89.016a+b, Lelystad, The Netherlands.

Stotz G. and Knoche G., 1999. Herkunft und auswirkung von Cu, Zn, Ni, Cd und Hg aus diffusen quellen auf oberflächengewässer. UBA Forschungsvohaben 297 24 519. Universität Stuttgart.

Sutherland, R.A. et al., 2000b. Operationally Defined Metal Fractions in Road Deposited Sediment, Honolulu, Hawaii. Journal Environ. Qual. 29 (2000) 1431-1439.

Sutherland, R.A. and C.A. Tolosa, 2000a. Multi-element analysis of road-deposited sediment in an urban drainage basis, Honolulu, Hawaii. Environmental Pollution 110 (2000) 483-495.

Sutherland, R.A. et al., 2001. Metal extraction from road sediment using different strength reagents: impacts on antropogenic contaminant signals. Environmental Monitoring and Assessment 71: 221-242, 2001.

Sutherland, R.A. 2002. Comparison between non-residual Al, Co, Cu, Fe, Mn, Ni Pb, and Zn released by a three-step sequential extraction procedure and a dilute hydrochloric acid leach for soil and road deposited sediment. Applied Cheocheistry 17, 353-365.

Tauw, 1995. Inventarisatie kwaliteit wegbermen van provinciale wegen in Groningen. Tauw report 3270505.H01/BAN, Groningen, The Netherlands.

Thornton, I., Rautiu, R. & Brush, S., 2001. Nickel the facts. An independent report on Nickel and its industry. Prepared by IC Consultants Ltd, London, UK.

Tipping E, Lofts S, Lawlor AJ (1998): Modeling the chemical speciation of trace metals in the surface waters of the Humber system. Sci.Total Environ. 210/211: 63-77.

Torres, K. C. and M.L. Johnson, 2001. Bioaccumulation of metals in plants, arthropods and mice at a seasonal wetland Environmental Toxicology and Chemistry Vol 20 (11): 2617-2626.

Turner A, Martino M, Le Roux SM (2002): Trace metal distribution coefficients in the Mersey Estuary, UK: evidence for salting out of metal complexes. Environ.Sci.Technol. 36: 4578-2584.

Unger, H.-J. and D. Prinz, 1992. Verkehrsbedingte Immissionen in Baden-Württemberg – Schwermetalle und organische Fremdstoffe in straβennahen Böden und Aufwuchs. Institut für Wasserbau und Kulturtechnik der Universität Karlsruhe.

URS, 2002. Draft report. Nickel Risk Assessment United Kingdom; Environment (Exposure only). On behalf of NIPERA.

US-EPA (1999): Partition coefficients for metals in surface water, soil and waste. Draft Prepared by HydroGeoLogic Inc and Allison Geoscience Consultants for the US-Environmental Protection Agency, Office of Solid Waste, Washington DC.

Van Der Kooij LA, Van De Meent D, Van Leeuwen CJ, Bruggeman WA (1991): Deriving quality criteria for water and sediment from the results of aquatic toxicity tests and product standards: application of the equilibrium partitioning method. Wat.Res. 25: 697-705.

Van der Weijden CH, Arnoldus MJHL, Meurs CJ (1977): Desorption of metals from suspended matter in the rhine estuary. Netherlands Journal of Sea Research 11(2): 130-145

Veselý J, Majer V (1998): Hydrogeochemical mapping of Czech freshwaters. Bull.Czech Geol.Survey 73: 183-192.

Veselý J, Majer V. Kucera J, Havránek V (2001): Solid-water partitioning of elements in Czech freshwaters. Appl.Geochem. 16: 437-450.

Ward I.N., 1990. Multi-element contamination of British motorway environments. The Science of the Total Environment, 93:393-401.

Westhoek, H.J. et al., 1996. Aan- en afvoerbalansen van zware metalen van Nederlandse landbouwgronden. Informatie- en KennisCentrum Landbouw/Ede, juni 1996.

Wilber W.G. , J.V. Hunter, 1979. Distribution of metals in street sweepings, stormwater solids, and urban aquatic sediments Journal WPCF Vol 51(12):2810-2814.

Wösten, M.A.D., J. Blok, E.J. van de Plassche, 2001. International Environmentally Quality Standard Setting. RoyalHaskoning/National Institute of Public Health and the Environment The Netherlands.

WHO (1991): Nickel. Environmental Health Criteria 108. World Health Organization, Geneva. 383 pp.

Wyers, G.P., F.P. Bakker et al., 1992. Meting massastromen van zware metalen van de weg naar de direct omgeving (III). Ministerie van Verkeer en Waterstaat, Dienst Weg- en Waterbouwkunde. W-DWW-92-721. Delft, The Netherlands.

Wyers, G.P., F.P. Bakker et al., 1991. Meting van massastromen van zware metalen van een snelweg naar de berm. Ministerie van Verkeer en Waterstaat, Dienst Weg- en Water-bouwkunde. ECN-C—91-046. Delft, The Netherlands.

Wyers, G.P., F.P. Bakker et al., 1992. Meting van massastromen van zware metalen van de weg naar zijn directe omgeving (II). Ministerie van Verkeer en Waterstaat, Dienst Weg- en Waterbouwkunde. MI-OW-91-45. Delft, The Netherlands.

Wyers, G.P., F.P. Bakker, B.C. Broersen and J.J. Möls, 1990. Meting van massastromen van zware metalen door natte en droge verwaaiing van een snelweg naar de berm. Vervolg op eerder onderzoek. Ministerie van Verkeer en Waterstaat, Dienst Weg- en Waterbouwkunde. ECN-C—90-020. Delft, The Netherlands.

VMM (2003): Waterkwaliteit, lozingen in het water 2003. Zuivering van gemengd & huishoudelijk afvalwater in Vlaanderen (database). Vlaamse Milieumaatschappij, 2003.

World Bureau of Metal Statistics, 2000. World metal statistics yearbook 2000. US, 73 p.

Yassoglou N., et al., 1987. Heavy metal contamination of roadside solids in the Greater Athens Area. Environmental Pollution 47 (1987) 293-304.

Yläranta, T., 1994. Effect of road traffic on heavy metal concentrations of plants Agricultural Science in Finland Vol. 4: 35-48.

Yläranta, T., 1994. Effect of road traffic on heavy metal concentrations of plants. Agricultural Science in Finland. Vol.4: 35-48.

Youssef, Y.A. et al., 1985. Consequential Species of Heavy Metals in Highway Runoff. Transportation Research Record 1017, pg 56-62.

Zehetner F, Wenzel WW (2000): Nickel and copper sorption in acid forest soils. Soil Science 165(part 6): 463-472.

Zhou JL, Liu YP, Abrahams PW (2003): Trace metal behaviour in the Conwy estuary, North Wales. Chemosphere 51: 429-440.

6.1.2 References, Section 3.1, fate and distribution

- Heijerick D.H. & Van Sprang P.A. (EURAS), 2004. Review of nickel partitioning coefficients in the aquatic environment and processes causing the observed variation, study prepared by EURAS for NiPERA, final report, November 2004, 35 p. **Appendix B.1.**

Benoit G, 1994. Clean technique measurement of Pb, Ag and Cd in fresh water: a redefinition of metal pollution. Environ.sci.Technol; 28, 1987-1991.

Benoit G, 1995. Evidence of the particle concentration effect for lead and other metals in fresh waters based on clean technique analyses. Geochim.Cosmochim.acta 59, 2677-2687.

Benoit G, Rozan TF, 1999. The influence of size distribution on the particle concentration effect and trace metal partitioning in rivers. Geochim.Cosmochim.Acta 63, 113-127.

Bird GA, Schwartz W, 1997. Distribution coefficients K_Ds for iodide in Canadian shield lake sediments under oxic and anoxic conditions. J.Environ.Radioact. 35, 261-279.

Bourg ACM, 1987. Trace metal adsorption modelling and particle-water interactions in estuarine environments. Contin.Shelf Res. 7, 1319-1322.

Comber SDW, Gunn AM, Whalley C, 1995. Comparison of the partitioning of trace metals in the Humber and Mersey estuaries. Mar.Pollut.Bull. 30, 851-860.

Crommentuijn, T., Polder, M.D. and van de Plassche, E.J. (1997). Maximum Permissible Concentrations and Negligible Concentrations for metals, taking background concentrations into account. National Institute of Public Health and Environmental Protection, Bilthoven, The Netherlands. Report N° 601501 001.

Elbaz-Poulichet F, Garnier J-M, Guan DM, Martin J-M, Thomas AJ, 1996. The conservative behaviour of trace metals (Cd, Cu, Ni and Pb) and As in the surface plume of stratified estuaries: example of the Rhöne River (France). Estuar.Coast.Shelf Sci. 42, 289-310.

Garnier J-M, Pham MK, Ciffroy P, Martin J-M, 1997. Kinetics of trace element complexation with suspended matter and with filterable ligands in freshwater. Environ.Sci.Technol. 31, 1597-1606.

Goldstein SJ, Jacobsen SB, 1988. Rare earth elements in river waters. Earth Plant.Sci.Lett. 89, 35-47.

Guieu C, Mouchel JM, Noël mH, Guan DM, Martin JM, 1991. Flux and behaviour of trace metals in the Ebro Delta, Spain. In: Martin JM, Barth H, Eds. Water Pollution Research Report 28, EROS-2000 (European River Ocean system) Second Workshop on the north-west Mediterranean. Pp. 293-307.

Hassan SM, Garrison AW, Allen HE, Di Toro DM, Ankley GT, 1996. Estimation of partition coefficients for five trace metals in sandy sediments and application to sediment quality criteria. Environ.Toxicol.Chem. 15, 2198-2208.

Honeyman BD, Santschi PH, 1988. Metals in aquatic systems. Environ.Sci.Technol. 22, 862-871.

Koelmans AA, Lijklema L, 1992. Sorption of 1,2,3,4-tetrachlorobenzene and cadmium to sediments and suspended solids in Lake Volkerak/Zoom. Wat.Res. 26, 327-337.

Koelmans AA, Radovanovic H, 1997. Modeling trace metal distribution in surface waters, Model formulations and calibrations. Wageningen Agricultural University, The Netherlands.

Koelmans AA, Radovanovic H, 1998. Prediction of trace metal distribution coefficients (K_D) for aerobic sediments. Water Sci.Technol. 37, 71-78.

Lee S, Allen HE, Huang CP, Sparks DL, Sanders PF, Peijnenburg WJGM, 1996. Predicting soil-water partition coefficients for cadmium. Environ.Sci.Technol. 30, 3418-3424.

Leeks GJL, Neal C, Jarvie HP, Casey H, Leach DV, 1997. The LOIS River monitoring network: strategy and implementation. Sci.Total Environ. 194/195, 101-109.

Li Y, 1982. Geochim.Cosmochim. Acta 46, 1053-1060.

Lofts S, Tipping E, 1998. As assemblage model for cation-binding by natural particulate matter. Geochim.Cosmochim.Acta 62, 2609-2625.

Lofts S, Tipping E, 2000. Solid-solution metal partitioning in the Humber rivers: application of WHAM and SCAMP. Sci.Total Environ. 251-252, 381-399.

Martin JM, Nirel P, Thomas AJ 1987. Sequential extraction techniques: promises and problems. Mar.Chem 22, 313-314.

Martin JM, Dai M, Cauwet G, 1995. Significance of colloids in the biogeochemical cycling of organic carbon and trace metals in a coastal environment; example of the Venice lagoon (Italy). Limnol.Oceanogr. 40, 119-131.

Michaelis W, Prange A, 1988. Trace analysis of geological and environmental samples by total-reflection X-ray fluorescence spectrometry. Nuclear Geophysics 2, 231-245.

Millero F, 2000. The activity coefficients of non-electrolytes in seawater. Mar.Chem. 70, 5-22.

Neal C, Robson AJ, Jeffrey HA, 1997. Trace element inter-relationships for the Humber rivers: interferences for hydrological and chemical controls. Sci.Total Environ. 194/195, 321-343.

Nolting RF, Helder W, de Baar JW, Gerringa LJA, 1999. Contrasting behaviour of trace metals in the Scheldt estuary in 1978 compared to recent years. J.Sea Res. 42, 275-290.

Paucot H, Wollast R, 1997. Transport and transformation of trace metals in the Scheldt estuary. Mar.Chem. 58, 229-244.

Pettine M, Camusso M, Martinotti W, Marchetti R, Passino R, Queirazza G, 1994. Soluble and particulate metals in the Po River: factors affecting concentrations and partitioning. Sci.Total Environ. 145, 243-265.

Radovanovic H, Koelmans AA, 1998. Prediction of in situ trace metal distribution coefficients for suspended solids in natural waters. Environ.Sci.Technol. 32, 753-759.

Sholkovitz ER, 1992. Chemical evolution of rare earth elements: fractionation between colloidal and solution phases of filtered river water. Earth Planet.Sci.Lett. 114, 77-84.

Smith RM, Martell AE, 1976. Critical Stability Constants, Vol. 4, Inorganic Complexes. Plenum Press, New York.

Stortelder PBM, Van der Gaag, MA, Van der Kooy LA, 1989. Perspectives for water organisms (part 1 and 2). DBW/RIZA Nota No. 89.016a+b, Lelystad, The Netherlands.

Tessier A, Campbell PGC, Bisson M, 1979. Sequential extraction procedure for the speciation of particulate trace metals. Anal. Chem. 51, 844-851.

Tessier A, Fortin D, Belzile N, Devitre RR, Leppard GG, 1996. Trace metal-sediment interactions in two shield lakes. Geochim.Cosmochim.Acta 60,387-404.

Tipping E, 1993a. Modelling ion-binding by humic acids. Colloids Surf. A: Physicochem. Eng. Aspects 73, 117-131.

Tipping E, 1993b. Modeling the competition between alkaline earth cations and trace metal species for binding by humic substances. Environ.Sci.Technol. 27, 520-529.

Tipping E, 1994. WHAM – a chemical equilibrium model and computer code for waters, sediments and soils incorporating a discrete site/electrostatic model of ion-binding by humic substances. Comp.Geosci. 20, 973-1023.

Tipping E, Lofts S, Lawlor AJ, 1998. Modeling the chemical speciation of trace metals in the surface waters of the Humber system. Sci.Total Environ. 210/211, 63-77.

Trefry JM, Nelson TA, Trocine RP, Metz S, Vetter TW, 1986. Trace metal fluxes through the Mississippi River delta system. Rapp.P-V. Réun.Cons.Int.Explor.Mer. 186, 277-288.

Turner A, Martino M, Le Roux SM, 2002. Trace metla distribution coefficients in the Mersey Estuary, UK: evidence for salting out of metal complexes. Environ.Sci.Technol. 36, 4578-2584.

Turner A, Millward GE, Schuchardt B, Schirmer M, Prange A, 1992. Trace metal distribution coefficients in the Weser estuary (Germany). Cont.Shelf Res. 12, 1277-1292.

Van Der Kooij LA, Van De Meent D, Van Leeuwen CJ, Bruggeman WA, 1991. Deriving quality criteria for water and sediment from the results of aquatic toxicity tests and product standards: application of the equilibrium partitioning method. Wat.Res. 25, 697-705.

Venema R, 1994. Gehalte in zwevend stof, meten of berekenen? RIZA-werkdocumnt No. 94064x (In Dutch).

Venema R, 1996. K_D-waarden van zware metalen in zoetwater sediment. RIZA-werkdocument No. 96.180.X (In Dutch).

Veselý J, Majer V, 1998. Hydrogeochemical mapping of Czech freshwaters. Bull.Czech Geol.Survey 73, 183-192.

Veselý J, Majer V. Kucera J, Havránek V, 2001. Solid-water partitioning of elements in Czech freshwaters. Appl.Geochem. 16, 437-450.

Wang F, Chen J, Forsling W, 1997. Modeling sorption of trace metals on natural sediments by surface complexation model. Environ.Sci.Technol. 31, 448-453.

Webster JG, Swedlund PJ, Webster KS, 1998. Trace metal adsorption onto an acid-mine drainage iron(III) oxy hydroxyl sulphate. Environ.Sci.Technol. 32, 1361-1368.

Xue HB, Gächter R, Sigg L, 1997. Comparison of Cu and Zn in eutrophic lakes with oxic and anoxic hypolimnion. Aquat.Sci. 59, 176-189.

Yeats PA, Bewers JM, 1982. Discharge of metals from St. Lawrence River. Can.J.Earth Sci. 19, 982-992.

Yland E, 1996. Partitiecoëfficiënten tussen sediment en water voor metalen berekend uit mariene monitoringsgegevens en analyse vanhet aandeel van de achtergrondwaarde op de zwevend stof/water coëfficiënt. RIKS/OS96.141x (In Dutch).

Yland E, Smedes F, 1996. Partitiecoëfficiënten tussen zwevend stof en water voor metalen berekend uit mariene monitoringsgegevens. RIKZ/OS96.117x (In Dutch).

Zhang J, Huang WW, Wang JH, 1994. Trace metal chemistry of the Huanghe (Yellow River), China – examination of the data from in situ measurements and laboratory approach. Chem.Geol. 114, 83-94.

Zhou JL, Liu YP, Abrahams PW, 2003. Trace metal behaviour in the Conwy estuary, North Wales. Chemosphere 51, 429-440.

6.1.3 References, Section 3.1, local exposure report/emission inventory/regional pec derivation

- EURAS, 2005. Local environmental exposure report Ni metal and Ni compounds. Study prepared for NiPERA, final report, January 2005, 142p. **Appendix C.1.** Please note that the revisions after January 2005 made to this document are included in R311_0501_PEClocal.

- EURAS & ECOLAS, 2005. Regional exposure assessment: Assessment of point and diffuse environmental sources of Ni and Ni compounds and PEC derivation (EUSES). Study prepared for NiPERA, final report, February 2005, 64 p. **Appendix C.2.**

- ECOLAS, 2005. Assessment of point and diffuse environmental sources of nickel and nickel compounds as a basis for regional exposure assessment under European Council Regulation (EEC) N°793/93. Study prepared for NiPERA, Final report, January 2005, **Appendix C.3. + 3 annexes to the document**

- Smolders E. & Nziguheba G. (KUL), 2005. Trace elements in mineral fertilisers used in Europe (EU-15). Study prepared for NiPERA, final report, 20 p. **Appendix C.4.**

Bonten F.T.C. and Römkens P.F.A.M. (2004). Uitspoeling van zware metalen uit landbouwgronden. Modellering van uitspoeling op regionale schaal: modelaanpak en resultaten modelberekening. *(Leaching of heavy metals from agricultural soil. Modelling of leaching on a regional scale).*

Commission of the European Communities (EC), 1996, 2003. Technical guidance document in support of Commission Directive 93/67/EEC on risk assessment for new notified substances and Commission Regulation (EC) No 1488/94 on risk assessment for existing substances. Part II: Environment. Office for Official Publications of the European Communities, Luxembourg.

Davis A.P. et.al.(2001). Loading estimates of nickel, copper, cadmium, and zinc in urban runoff from specific sources. Chemosphere 44: p. 997-1009.

de Groot A., Peijnenburg W., van den Hoop M., Ritsema R., van Veen R.P.M., 1998. Heavy metals in Dutch field soils: an experimental and theoretical study on equilibrium partitioning. RIVM report no. 607220001.

Delahaye *et al.* (2003). Emissie van zeven zware metalen naar landbouwgrond. Centraal Bureau voor de Statistiek. Voorburg/Heerlen.

Desmet H. *et.al.* (2001). Bepaling van het huishoudelijk lozingsgedrag in Vlaanderen in het kader van de wetenschappelijke onderbouwing van de milieuheffing. EPAS nv, studie in opdracht van VMM. (Determination of municipal wastewater in Flanders in the framework of the environmental levies, study on behalf of VMM).

ECOLAS (2004a). Assessment of point and diffuse sources of copper and copper(compounds) as a basis for regional and continental exposure assessment (draft). Unpublished. Study commissioned by the European Copper Institute.

ECOLAS (2004b). Assessment of point and diffuse sources of lead and lead(compounds) as a basis for regional and continental exposure assessment (draft). Unpublished. Study commissioned by the Lead Development Association International.

ECOLAS (2005). Assessment of point and diffuse sources of nickel and nickel(compounds) as a basis for regional and continental exposure assessment. Draft of January 2005. Study commissioned by Nickel Producers Environmental Research Association.

EEA (1999). EMEP-CORINAIR atmospheric emission inventory guidebook. Second edition. European Environmental Agency.

ELSIA (2002). Unpublished data.

EURAS, 2005. Local exposure assessment of Ni metal and Ni compounds. Draft of 24 January, 2005. Study commissioned by Nickel Producers Environmental Research Association.

EU (2004). European Union Risk Assessment study for zinc and zinc compounds.

European Commission (2001). Pollutants in urban wastewater and sewage sludge. Final report prepared by ICON (IC Consultants, London) for the Directorate-General Environment.

European Commission (2003). Sewage sludge: current situation in the EU and future perspectives. Presentation from Luca Marmo of DG Environment.

European Communities (EC), 2003. Technical Guidance Document on Risk Assessment in support of Commission Directive 93/67/EEC on Risk Assessment for new notified substances, Commission Regulation (EC) No 1488/94 on Risk Assessment for existing substances and Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market. Part II: Environment.

EC, 2004. European Union System for the Evaluation of Substances 2.0 (EUSES 2.0). Prepared for the European Chemicals Bureau by the National Institute of Public Health and the Environment (RIVM), Bilthoven, The Netherlands. Available via the European Chemicals Bureau, http://ecb.jrc.it.

Eurostat (2003a). Energy balance sheets.

Eurostat (2003b). Agriculture Statistical Yearbook: data 1992-2001, detailed tables.

FAO (Food and Agriculture Organization of the United Nations), 2004. FAO Statistics http://www.fao.org/waicent/portal/statistics_en.asp

FEFAC (European Feed Manufacturers Federation, 2004). Personal communication from Arnaud Bouxin.

Foreign Agricultural Services (2004). United States Department of Agriculture. (http://www.fas.usda.gov)

Haskoning (2000). Onderzoek naar emissies uit huishoudens. Eindrapport van een studie in opdracht van het Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling (RIZA). Ref. H2425.AO/R005/IK/AS. (*Study on emissions from households. Final report of a study on behalf of the RIZA*)

Haskoning (2003). Data review for the exposure of soil and road borders to nickel.

Heijerick D. & Van Sprang P., 2005a. Probabilistic Distribution of Nickel in European Surface waters. Report prepared for the Nickel Producers Environmental Research Association (NiPERA). Final report, January 2005.

Heijerick D. & Van Sprang P., 2005b. Probabilistic Distribution of Nickel in European freshwater sediments. Report prepared for the Nickel Producers Environmental Research Association (NiPERA). Final report, January 2005.

Heijerick D. & Van Sprang P., 2005c. Data analysis and PEC derivation of Ni concentrations in European soils. Report prepared for the Nickel Producers Environmental Research Association (NiPERA). Final report, January 2005.

Heijerick DG, Van Sprang PA, 2005d. Review of nickel partitioning coefficients in the aquatic environment and processes causing the observed variation. Report prepared for the Nickel Producers Environmental Research Association (NiPERA). Draft Final Report, 35p.

IFA (International Fertiliser Industry Associaton, 2004). Nitrogen, phosphate and potash statistics 1973-1973/74 to 2001-2001/02. http://www.fertilizer.org/ifa/statistics/IFADATA/dataline.asp).

Jenkins David (1998). The effect of reformation of household powder laundry detergents on their contribution to metals levels in wastewater. Water Environment Research, Volume 70, Number 5, p. 980-983.

Jönsson H. *et.al.* (1997). Source separated urine-nutrient and metal content, water saving and faecel contamination. Water Science and Technology, Volume 35, Number 9, p. 145-152.

Klein, J., van den Brink, R., Hulskotte, J., Annema, J.A., van den Roovart, J., Borst, M., Gense, R. & van de Burgwal, E. (2002). Methoden voor de berekening van de emissies door mobiele bronnen in Nederland (*Methodologies for the calculation of emissions from mobile sources in The Netherlands*). Rapportagereeks Milieumonitor Nr. 4, Januari 2002.

Menzi H., Pain B. and Smith K. (1998). Solid manure in Europe. Results of a survey by the Working Group on solid manure of RAMIRAN. Proceedings of the 8th International Conference on the FAO Escorena Network on recycling of agricultural, municipal and industrial residues in agriculture. Rennes, France, 26-29 May, 1998.

Römkens P. (2003). Heavy metal balances: concepts, applicability and results. Abstracts for the Workshop on Assessment of heavy metal inputs into agro-ecosystems. Concerted action AROMIS. Health November 24-24, 2003 in Kloster Banz, Germany.

Römkens P.F.A.M., Bonten L.T.C., Rietra R.P.J.J., Groenenberg J.E., Plette A.C.C. and Bril J. (2003). Uitspoeling van zware metalen uit landbouwgronden. Schatting van de bijdrage van de uitspoeling uit landbouwgronden aan de belasting van het oppervlaktewater: modelaanpak en resultaten. *(Leaching of heavy metals from agricultural soil. Estimation of the contriubtion of leaching from agricultural soils to the total load to surface water).*

Stotz G. and Knoche G. (1999). Herkunft und auswirkung von Cu, Zn, Ni, Cd und Hg aus diffusen quellen auf oberflächengewässer. UBA Forschungsvohaben 297 24 519. Universität Stuttgart.

Thornton, I., Rautiu, R. & Brush, S. (2001). Nickel the facts. An independent report on Nickel and its industry. Prepared by IC Consultants Ltd, London, UK.

US-EPA (1995). Compilation of air pollutant emission factors, AP-42, fifth edition, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, November 1996.

Van Tilborg W.J.M. (2004). Non-ferrous metals balances in agricultural soils. Report no 0303.

6.1.4 References, Section 3.1, Monitoring Data

- Heijerick D.H. & Van Sprang P.A. (EURAS), 2006. Probabilistic distribution of nickel in European surface waters, study prepared by EURAS for NiPERA, final report, January 2006, 74 p. **Appendix D.1.**
- Heijerick D.H. & Van Sprang P.A. (EURAS), 2006. Probabilistic distribution of nickel in European freshwater sediments, study prepared by EURAS for NiPERA, final report, January 2006, 74 p. **Appendix D.2.**
- Heijerick D.H. & Van Sprang P.A. (EURAS), 2006. Data analysis and PEC derivation of Ni concentrations in European soils, study prepared by EURAS for NiPERA, final report, January 2006, 75 p. **Appendix D.3.**
- Heijerick D.H. & Van Sprang P.A. (EURAS), 2008. Determination of reasonable worst case (RWC) ambient PEC concentrations for nickel in the marine environment, study prepared by EURAS for NiPERA, final report, February 2008, 18 p. Appendix D.4.

6.1.5 References, Section 3.1, Water

Åström M, 1996. Geochemistry, chemical reactivity and extent of leaching of sulphide-bearing fine-grained sediment in Southern Ostrobothnia, Western Finland. PhD thesis, Åbo Akademi University.

Borg H, Trace metals and water chemistry of forest lakes in northern Sweden. Water research, 21, 65-72.

Bubb JM, Lester JN, 1996. Factors controlling the accumulation of metals within fluvial systems. Environmental Monitoring and Assessment 41, 87-105.

Campbell JA, Whitelaw K, Riley JP, Head PC, Jones PD, 1988. Contrasting behaviour of dissolved and particulate nickel and zinc in a polluted estuary. *The Science of the Total Environment*, 71, 141-155.

Chiffoleau JF, Cossa D, Auger D, Truquet I, 1994. Trace metal distribution, partition and fluxes in the Seine estuary (France) in low discharge regime. *Marine Chemistry*, 47, 145-158.

COMMPS, Commission of the European Communities (EC), 1999. Study on the prioritisation of substances dangerous to the aquatic environment. Revised proposal for a list of priority substances in the context of the Water Framework Directive (COMMPS procedure). Office for Official Publications of the European Communities, Luxembourg, 262 p.

Crommentuyn T, Polder MD, van de Plassche EJ, 1997. Maximum permissible concentrations and negligible concentrations for metals, taking background concentrations into account. RIVM Report No. 601501001.

EC (Commission of the European Communities), 1996, revised 2003. Technical Guidance Document in support of Commission Directive 93/67/EEC on risk assessment for new notified substances and Commission Regulation (EC) No 1488/94 on risk assessment for existing substances. Part II: Environment. Office for Official Publications of the European Communities, Luxembourg.

Cullen A.C. & Frey H.C., 1999. Probabilistic techniques in exposure assessment. A handbook for dealing with variability and uncertainty in models and inputs. Plenum Press, New York & London. 335 p.

Hall IR, Hydes DJ, Statham PJ, Overnell J, 1996. Dissolved and Particulate Trace Metals in a Scottish Sea Loch: an Example of a Pristine Environment. *Marine Pollution Bulletin*, 32, 846-854.

Koelmans AA, Radovanovic H, 1997. Modeling Trace Metal Distribution in Surface Waters, Model Formulations and Calibration. Wageningen Agricultural University.

Klaine S.J., Cobb G.P., Dickerson R.L., Dixon K.R., Kendall R.J., Smith E.E. and K.R. Solomon. 1996. An ecological risk assessment for the use of the biocide, dibromonitrilopropionamide (DBNPA) in industrial cooling system. *Environmental Toxicology and Chemistry* 15:21-30.

Lahermo P, Väänänen P, Tarvainen T, Salminen R, 1996. Suomen Geokemian Atlas – Geochemical Atlas of Finland. Geological Survey of Finland, ESPOO, 149 p.

Lofts S, Tipping E, 2000. Solid-solution metal partitioning in the Humber rivers: application of WHAM and SCAMP. *The Science of the Total Environment*, 251-252, 381-399.

Mannio J, Järvinen O, Tuominen R, Verta M. Survey of trace elements in lake waters of Finnish Lapland using the ICP-MS technique. The Science of the Total Environment 160/161, 433-439.

Nolting RF, Helder W, de Baar HJW, Gerringa LJA, 1999. Contrasting behaviour of trace metals in the Scheldt estuary in 1978 compared to recent years. *Journal of Sea Research*, 42, 275-290.

Paucot H, Wollast R, 1997. Transport and Transformation of trace metals in the Scheldt estuary. *Marine Chemistry*, 58, 229-244.

Pettine M, Camusso M, Martinotti W, Marchetti R, Passino R, Queirazza G, 1994. Soluble and particulate metals in the Po River: factors affecting concentrations and partitioning. *The Science of the Total Environment* 145, 243-265.

Regnier P, Hoenig M, Chou L, Wollast R, 1990. Trace metals in the suspended matter collected in the mixing zone of the Rhone estuary. *Water Pollution Research*, 20, 385-396.

Schuiling RD, 1974. Natural erosion as a reference for transport of elements. Geologie en mijnbouw 53, 195-197 (in Dutch).

Solomon K.R., Baker D.B., Richards P., Dixon K.R., Klaine S.J., La Point T.W., Kendall R.J., Giddings. J.M., Giesy J.P. and L.W.J. Hall. 1996. Ecological risk assessment of atrazine in North American surface waters. *Environmental Toxicology and Chemistry* 15:31-76. 63-77.

Solomon K.R. and Chappel M.J., 1998. Triazine herbicides: Ecological risk assessment in surface waters. In: Ballantine L., Mc Farland J., Hackett D.,eds. Triazine risk assessment. Washington DC/ American Chemical Society. p. 357-368.

Stortelder PBM, Van der Gaag MA, Van der Kooy LA, 1989. Perspectives for water organisms (part 1 and 2) DBW/RIZA Nota No. 89.016a+b, Lelystad, The Netherlands.

Tipping E, Lofts S, Lawlor AJ, 1998. Modelling the chemical speciation of trace metals in the surface waters of the Humber system. *The Science of the Total Environment*, 210-211, 63-77.

Turner A, Millward GE, Schuchardt B, Schirmer M, Prange A, 1992. Trace metal distribution coefficients in the Weser Estuary (Germany). *Continental Shelf Research*, 12, 1277-1292.

Ukonmaanaho L, Starr M, Hirvi J-P, Kokko A, Larehmo P, Mannio J, Paukola T, Ruoho-Airola T, Tanskanen H, 1998. Heavy metal concentrations in various aqueous and biotic media in Finnish Integrated Monitoring catchments. Boreal Environment Research, 3, 235-249, 1998.

Umweltsbundesamt, 1996. Wasserbeschaffenheit ausgewählter Fliessgewasser in der Bundesrepublik Deutschland – Datensammlung – Schwermetalle. Report Umweltsbundesamt, Berlin, ISSN 0722-186X, 191 p.

Van den Berg G and Zwolsman J, 2000. New method for the determination of background concentrations for heavy metals in water. H2O 24, 23-25 (in Dutch).

Van der Weijden C.H. & Middelburg J.J., 1989. Hydrogeochemistry of the river Rhine; long term and seasonal variability, elemental budgets, base levels and pollution. *Water Research*, vol 23(10), 1247-1266.

Van Os BJH, Klaver GT and Huisman DJ, 2001. Natuurlijke koper- en zinkwaarden in sedimenten van pre-industriele ouerdom (Natural copper and zinc values in sediments of pre-industrial age, in Dutch). TNO-NITG 01-202-B, Utrecht.

Van Tilborg WJM, 2002. Natural background/ambient concentrations of metals and abiotic conditions of fresh surface waters in relation to risk assessment of metals. Report No. 0203, VTBC Van Tilborg Consultancy BV, 71p.0

Venema R, 1994. Concentrations in suspended solids, measuring or deriving? RIZA werkdocument No.94064x, Lelystad, The Netherlands (In Dutch).

Venema R, 1996. Kd-values of heavy metals in freshwater sediment. RIZA-werkdocument No. 96.180.X, Lelystad, The Netherlands (In Dutch).

Verta M, Mannio J, Iivonen P, Hirvi J_P, Järvinen O, Piepponen S, 1990. In: Kauppi et al. (Eds.), Acidification in Finland. 1990.

Zhou JL, Liu YP, Abrahams PW, 2003. Trace metal behaviour in the Conwy estuary, North Wales. *Chemosphere*, 51, 429-440.

Zuurdeeg BW, Van Enk R, Vriend S, Bussink R, Molenaar A, Reijniewicz I, 1992 (in dutch). Natuurlijke achtergrondgehalten van zware metalen en enkele andere sporenelementen in Nederlands oppervlaktewater. Studie in opdracht van VROM, Geochem Research, Utrecht, 100p.

6.1.6 References, Section 3.1, Sediment

Bird GA, Schwartz W, 1997. Distribution coefficients (K_Ds) for iodide in Canadian shield lake sediments under oxic and anoxic conditions. J.Environ.Radioact. 35, 261-279.

Breukel RMA, 1993. Natuurlijke achtergrondgehalten van de Nederlandse rivieren, een keuze uit literatuurgegevens. RIAZ Werkdocument 93.139x, 1993.

Comber SDW, Gunn AM, Whalley C, 1995. Comparison of the partitioning of trace metals in the Humber and Mersey estuaries. Mar.Pollut.Bull. 30, 851-860.

COMMPS, Commission of the European Communities (EC), 1999. Study on the prioritization of substances dangerous to the aquatic environment. Revised proposal for a list of priority substances in the context of the Water Framework Directive (COMMPS procedure). Office for Official Publications of the European Communities, Luxembourg, 262 p.

Crommentuijn T, Polder MD, Van de Plassche EJ, 1997. Maximum permissible concentrations and negligible concentrations for metals, taking background concentrations into account. RIVM Report No. 601501 001.

Cullen A.C. & Frey H.C., 1999. Probabilistic techniques in exposure assessment. A handbook for dealing with variability and uncertainty in models and inputs. Plenum Press, New York & London. 335 p.

EC (Commission of the European Communities), 2003. Technical Guidance Document in support of Commission Directive 93/67/EEC on risk assessment for new notified substances and Commission Regulation (EC) No 1488/94 on risk assessment for existing substances. Part II: Environment. Office for Official Publications of the European Communities, Luxembourg.

Elbaz-Poulichet F, Garnier J-M, Guan DM, Martin J-M, Thomas AJ, 1996. The conservative behaviour of trace metals (Cd, Cu, Ni and Pb) and As in the surface plume of stratified estuaries: example of the Rhône River (France). Est.Coast.Shelf Sci. 42, 289-310.

Garnier J-M, Pham MK, Ciffroy P, Martin J-M, 1997. Kinetics of trace element complexation with suspended matter and with filterable ligands in freshwater. Environ.Sci.Technol. 31, 1597-1606.

Heijerick DG, Van Sprang PA, 2005. Review of nickel partitioning coefficients in the aquatic environment and processes causing the observed variation. Report prepared for the Nickel Producers Environmental Research Association (NiPERA). Draft Final Report, 35p.

Klaine S.J., Cobb G.P., Dickerson R.L., Dixon K.R., Kendall R.J., Smith E.E. and K.R. Solomon. 1996. An ecological risk assessment for the use of the biocide, dibromonitrilopropionamide (DBNPA) in industrial cooling system. Environmental Toxicology and Chemistry 15:21-30.

Koelmans AA, Radovanovic H, 1997. Modeling trace metal distributions in surface waters, Model formulations and calibration. Wageningen Agricultural University.

Koelmans AA, Radovanovic H, 1998. Prediction of trace metal distribution coefficients (KD) for aerobic sediments. Water Sci.Technol. 37, 71-78.

Lahermo P, Väänänen P, Tarvainen T, Salminen R, 1996. Suomen Geokemian Atlas – Geochemical Atlas of Finland. Geological Survey of Finland, ESPOO, 149 p.

Lofts S, Tipping E, 1998. An assemblage model for cation-binding by natural particulate matter. Geochim.Cosmochim.Acta 62, 2609-2625.

Lofts S, Tipping E, 2000. Solid-solution metal partitioning in the Humber rivers: application of WHAM and SCAMP. Sci.Total Environ. 251/252, 381-399.

Neal C, Robson AJ, Jeffrey HA, 1997. Trace element inter-relationships for the Humber rivers: interferences for hydrological and chemical controls. Sci.Total Environ. 194/195, 321-343.

Nolting RF, Helder W, de Baar JW, Gerringa LJA, 1999. Contrasting behaviour of trace metals in the Scheldt estuary in 1978 compared to recent years. J.Sea Res. 42, 275-290.

Paucot H, and Wollast R, 1997. Transport and transformation of trace metals in the Scheldt estuary. Mar.Chem. 58, 229-244.

Pettine M, Camusso M, Martinotti W, Marchetti R, Passino R, Queirazza G, 1994. Soluble and particulate metals in the Po River: factors affecting concentrations and partitioning. Sci.Total Environ. 145, 243-265.

Radovanovic H, Koelmans AA, 1998. Prediction of in situ trace metal distribution coefficients for suspended solids in natural waters. Environ.Sci.Technol. 32, 753-759.

Salomons W, 1983. Voorlopige base-line voor Cd, Zn, Ni, Pb, Cu and Cr in nederlande sedimenten. Delft, WL_rapport R1703, 1983.

Solomon K.R., Baker D.B., Richards P., Dixon K.R., Klaine S.J., La Point T.W., Kendall R.J., Giddings. J.M., Giesy J.P. and L.W.J. Hall. 1996. Ecological risk assessment of atrazine in North American surface waters. Environmental Toxicology and Chemistry 15:31-76.

Solomon K.R. and Chappel M.J., 1998. Triazine herbicides: Ecological risk assessment in surface waters. In: Ballantine L., Mc Farland J., Hackett D.,eds. Triazine risk assessment. Washington DC/ American Chemical Society. p. 357-368.

Stortelder PBM, Van der Gaag MA, Van der Kooy LA, 1989. Perspectives for water organisms (part 1 and 2). DBW/RIZA Nota No. 89.016a+b, Lelystad.

Swennen R, van der Sluys J, Hindel R, Brusselmans A, 1998. Geochemistry of overbank and high-order stream sediments in Belgium and Luxembourg: a way to assess environmental pollution. J.Geochem.Explor. 62, 67-79.

Tipping E, Lofts S, Lawlor AJ, 1998. Modeling the chemical speciation of trace metals in the surface waters of the Humber system. Sci.Total Environ. 210/211, 63-77.

Trefry JM, Nelson TA, Trocine RP, Metz S, Vetter TW, 1986. Trace metal fluxes through the Mississippi River delta system. Rapp.P-V. Réun.Cons.Int.Explor.Mer. 186, 277-288.

Turner A, Martino M, Le Roux SM, 2002. Trace metla distribution coefficients in the Mersey Estuary, UK: evidence for salting out of metal complexes. Environ.Sci.Technol. 36, 4578-2584.

Turner A, Millward GE, Schuchardt B, Schirmer M, Prange A, 1992. Trace metal distribution coefficients in the Weser estuary (Germany). Cont.Shelf Res. 12, 1277-1292.

Van de Meent D, Aldenberg T, Canton JH, Van Gestel CAM, Slooff W, 1990. Desire for levels. Background study for the policy document “Setting environmental quality standards for water and soil. RIVM-Report No. 670101 002.

Van Der Kooij LA, Van De Meent D, Van Leeuwen CJ, Bruggeman WA, 1991. Deriving quality criteria for water and sediment from the results of aquatic toxicity tests and product standards: application of the equilibrium partitioning method. Wat.Res. 25, 697-705.

Venema R, 1994. Gehalte in zwevend stof: meten of berekenen? RIZA-werkdocument no. 94064x (In Dutch).

Venema R, 1996. Kd-waarden van zware metalen in zoetwater sediment. RIZA-werkdocument no. 96.180.X (In Dutch).

Veselý J, Majer V. Kucera J, Havránek V, 2001. Solid-water partitioning of elements in Czech freshwaters. Applied Geochemistry 16, 437-450.

Xue HB, Gächter R, Sigg L, 1997. Comparison of Cu and Zn in eutrophic lakes with oxic and anoxic hypolimnion. Aquat.Sci. 59, 176-189.

Yeats PA, Bewers JM, 1982. Discharge of metals from St. Lawrence River. Can.J.Earth Sci. 19, 982-992.

Yland E, 1996. Partitiecoëfficienten tussen sediment en water voor metalen berekend uit mariene monitoringsgegevens en analyse van het aandeel van de achtergrondwaarde op de zwevend stof/water coëfficient. RIKZ/OS96.141x (In Dutch).

Yland E, Smedes F, 1996. Partitiecoëfficienten tussen zwevend stof en water voor metalen berekend uit mariene monitoringsgegevens. RIKZ/OS96.117x (In Dutch).

Zhang J, Huang WW, Wang JH, 1994. Trace metal chemistry of the Huanghe (Yellow River), China – examination of the data from in situ measurements and laboratory approach. Chem.Geol. 114, 83-94.

Zhou JL, Liu YP, Abrahams PW, 2003. Trace metal behaviour in the Conwy estuary, North Wales. Chem. 51, 429-440.

6.1.7 References, Section 3.1, Marine

Althaus M, 1992. Dissolved trace metals in the estuarine plumes of the Humber, Thames and Rhine rivers. PhD Thesis, University of Southampton, 331p.

Apte SC, Day GM, 1998. Dissolved metal concentrations in the torres strain and Gulf of Papua. Marine Pollution Bulletin 36, 298-304.

Banat IM, Hassan ES, El-Shahawi MS, Abu-Hilal AH, 1998. Post-Gulf war assessment of nutrients, heavy metal ions, hydrocarbons and bacterial pollution levels in the United Arab Emirates coastal waters. Environment International 24, 109-116.

Batley GE, 1996. Heavy metals and tributyltin in Australian coastal and estuarine waters. State of the marine environment report for Australia. Technical Annex 2. Department of the Environment, Sports and Territories, Canberra, Australia, pp. 63-72.

Bu-Olayan AH, Al-Hassan R, Thomas BV, Subrahmanyam MNV, 2001. Impact of trace metals and nutrients levels on phytoplankton from the Kuwait Coast. Environment International 26, 199-203.

Burton JD, Althaus M, Millward GE, Morris AW, Statham PJ, Tappin AD, Turner A, 1993. Processes influencing the fate of trace metals in the North Sea. Phil.Trans.R.Soc.Lond.A 343, 557-568.

Censi P, Spoto SE, Saiano F, Sprovieri M, Mazzola S, Nardone G, Di Geronimo SI, Punturo R, Ottonello D, 2006. Heavy metals in coastal water systems. A case study from the northwestern Gulf of Thailand. Chemosphere 64, 1167-1176.

Chiffoleau J-F, Cossa D, Auger D, Truquet I, 1994. Trace metal distribution, partition and fluxes in the Seine estuary (France) in low discharge regime. Marine Chemistry 47, 145-158.

Comber SDW, Gunn AM, Whalley C, 1995. Comparison of the partitioning of trace metals in the Humber and Mersey Estuaries. Marine Pollution Bulletin 30, 12, 851-860.

Cotté M-H, 1997. Origines et comportement des métaux dissous dans les eaux de la marge Altantique Européenne. PhD Thesis, University of Paris VI, 210 p.

Cotté-Krief M-H, Guieu C, Thomas AJ, Martin J-M, 2000. Sources of Cd, Cu, Ni and Zn in Portuguese coastal waters. Marine Chemistry 71, 199-214.

Cotté-Krief M-H, Thomas AJ, Martin J-M, 2002. Trace metal (Cd, Cu, Ni and Pb) cycling in the upper water column near the shelf edge of the European continental margin (Celtic sea). Marine Chemistry 79, 1-26.

Fang T-H, Lin C-L, 2002. Dissolved and particulate trace metals and their partitioning in a hypoxic estuary: the Tanshui Estuary in Northern Taiwan. Estuaries 25, 598-607.

Flegal AR, Smith GJ, Gill GA, Sanudo-Wilhelmy S, Anderson LCD, 1991. Dissolved trace element cycle in the San Francisco Bay estuary. Marine Chemistry 36, 329-363.

Hall IR, Hydes DJ, Statham PJ, Overnell, 1996. Dissolved and particulate trace metals in a Scottish Sea Loch: an example of a pristine environment? Marine Pollution Bulletin 32, 8469-854.

Hatje V, Aptez SC, Hales LT, Birch GF, 2003. Dissolved trace metal distributions in port Jackson estuary (Sydney Harbour), Australia. Marine Pollution Bulletin 46, 719-730.

Klinkhammer GP, Bender ML, 1981. trace metal distributions in the Hudson river estuary. Estuarine, Coastal and Shelf Science 12, 629-643.

Kremling K, 1985. Summer distribution of Cd, Cu, Ni, Mn and Al in surface waters around the British Isles. Cont.Shelf res. 32, 531-555.

Kremling K, Hydes DJ, 1988. Summer distribution of dissolved Al, Cd, Co, Cu, Mn and Ni in surface waters around the British Isles. Cont.Shelf Res. 8, 89-105.

Kremling K, Streu P, 2000. Further evidence for a drastic decline of potentially hazardous trace metals in Baltic Sea surface waters. Marine Pollution Bulletin 40, 674-679.

Kremling K, Tokos JJS, Brügmann L, Hansen H-P, 1997. Variability of dissolved and particulate trace metals in the Kiel and Mecklenburg Bights of the Baltic Sea, 1990-1992. Marine Pollution bulletin 34, 112-122.

Laslett RE, Balls PW, 1995. The behaviour of dissolved Mn, Ni and Zn in the forth, an industrialized, partially mixed estuary. Marine Chemistry 48, 311-328.

Mackey DJ, O'Sullivan JE, Watson RJ, Dal Pont G, 2002. Tracé metals in the western Pacific temporal and spatial variability in the concentrations of Cd, Cu, Mn and Ni. Deep Sea Research Part I Oceanographic Research Papers 49, 2241-2259.

Martino M, Turner A, Nimmo K, 2004. Distribution, speciation and particle-water interactions of nickel in the Mersey estuary, UK. Marine Chemistry, 88, 161-177.

McManus JP, Prandle D, 1996. Determination of source concentrations of dissolved and particulate trace metals in the southern North Sea. Marine Pollution Bulletin 32, 504-512.

Migon C, Ouillon S, Mari X, Nicolas E, 2007. Geochemical and hydrodynamic constraints no the distribution of trace metal concentrations in the lagoon of Nouméa, New Caledonia. Estuarine, Coastal and Shelf Science 74, 756-765.

Moran SB, Yeats PA, Balls PW, 1996. On the role of colloids in trace metal solid-solution partitioning in the continental shelf waters: a comparison of model results and field data. Continental Shelf Research 16, 397-408.

Munksgaard NC, Parry DL, 2001. Tracé metals, arsenic and lead isotopes in dissolved and particulate phases of North Australian coastal and estuarine seawater. Marine Chemistry, 75, 165-184.

Pourang N, Nikouyan A, Dennis JH, 2005. Trace element concentrations in fisg, surficial sediments and water from northern part of the Persian Gulf. Enviromnental Monitoring and Assessment 109, 293-316.

Saager PM, de Baar HJW, de Jong JTM, Nolting RF, Schijf J, 1997. Hydrography and local sources of dissolved trace metals Mn, Ni, Cu and Cd in the northeast Atlantic Ocean. Marine Chemistry 57, 195-216.

Sañudo-Wilhelmy SA, flegal AR, 1996. Trace metal concentrations in the surf zone and in coastal waters off Baja California, Mexico. Environmental Science and Technology 30, 1575-1580.

Sañudo-Wilhelmy SA, Rivera-Duarte I, Flegal AR, 1996. Distribution of colloidal trace metals in the San Francisco Bay estuary. Geochimica et Cosmochimica Acta 60, 4933-4944.

Sharp JH, Culberson CH, Church TM, 1982. The chemistry of the Delaware estuary. General considerations. Limnology and Oceanography 27, 1015-1028.

Sheppard C, 1993. Physical environment of the gulf relevant to marine pollution: an overview. Marine Pollution Bulletin 27, 3-8.

Statham PJ, Auger Y, Burton JD, Choisy P, fisher J-C, James RH, Morley NH, Ouddane B, Puskaric E, Wartel M, 1993. Fluxes of Cd, Co, Cu, Fe, Mn, Ni, Pb, and Zn through the strait of Dover into the North Sea. Oceanologica Acta 16, 541-552.

Statham PJ, Leclercq S, Hart V, Batté M, Auger Y, Wartel M, Cheftel J, 1999. Dissolved and particulate trace metal fluxes through the central English Channel , and the influence of coastal gyres. Continental Shelf Research 19, 2019-2040.

Syvitski JPM, Burrel DC, Skei JM, 1987. Fjords: processes and products. Springer Verlag.

Tappin AD, Millward GE, Statham PJ, Burton JD, Morris AW, 1995. Trace metals in the Central and Southern North Sea. Estuarine, Coastal and Shelf Science 41, 275-323.

Turner A, Millward GE, Schuchard B, Schirmer M, Prange A, 1992. Trace metal distribution coefficients in the Weser Estuary (Germany). Cont.Shelf Res. 12, 1277-1292.

Van Geen A, Boyle EA, Moore WS, 1991. Trace metal enrichments in waters of the Gulf of Cadiz, Spain. Geochim.Cosmochim.Acta 55, 2173-2191.

Wen L-S, Jiann K-T, Santschi PH, 2006. Physicochemical speciation of bioactive trace metals (Cd, Cu, Fe, Ni) in the oligotrophic South China Sea. Marine Chemistry 101, 104-129.

YeeD, Grieb T, Mills W, Sedlak M, 2007. Synthesis of long-term nickel monitoring in San Francisco Bay. Environmental Research 105, 20-33.

6.1.8 References, Section 3.1, Soil

Andersson A, Nilsson KO, 1976. Influence on the levels of heavy metals in soil and plant from sewage sludge used as fertilizer. Swedish J.Agric.Res. 6, 151-159.

ANPA, 2003; Atlante degli indicatoridel suolo. Agenzia Nazionale per la Protezione dell'Ambiente Allegati (http://www.sinanet.apat.it/documentazione ctnssc/atlante.htm)

Bak J, Jensen J, Larsen MM, Pritzl G, Scott-Fordsmand, 1997. A heavy metal monitoring programme in Denmark. Sci.Total Environ. 207, 179-186.

Bayrischer Staatsministerium für Landesentwichlung und Umweltfragen, 1995. Soil background and reference values in Germany. Bundesländer Arbeitsgruppe Bodenshutch.

Chaudri AM, Allain CMG, Barbosa-Jefferson VL, Nicholson FA, Chamvers BJ, McGrath SP, 2000. A study of the impacts of Zn and Cu on two rhizobial species in soils of a long-term field experiment. Plant and Soil, 221, 167-179.

COMMPS, Commission of the European Communities (EC), 1999. Study on the prioritization of substances dangerous to the aquatic environment. Revised proposal for a list of priority substances in the context of the Water Framework Directive (COMMPS procedure). Office for Official Publications of the European Communities, Luxembourg, 262 p.

Dahlin S, Witter E, Mårtensson, Turner A, Bååth E, 1997. Where's the limit? Changes in the microbiological properties of agricultural soils at low levels of metal contamination. Soil Biol.Biochem. 29, (9)1405-1415.

De Temmerman L, Vanongeval L, Boon W, Hoenig M, Geypens M, 2003. Heavy metal content of arable soils in Northern Belgium. Water Air Soil Pollut. 146, 61-76.

EC (Commission of the European Communities), 1996, revised 2003. Technical Guidance Document in support of Commission Directive 93/67/EEC on risk assessment for new notified substances and Commission Regulation (EC) No 1488/94 on risk assessment for existing substances. Part II: Environment. Office for Official Publications of the European Communities, Luxembourg.

EC, 2000. Heavy metal (trace element) contents of European soils. Heavy metal background and organic matter in european soils.

European Soil Bureau – Scientific Committee, 1999. Heavy Metals (Trace elements) and Organic Matter Content of European Soils – a Feasability Study. Report by the European Soil Bureau. – Scientific Committee. Authors: Baize D, Bidoglio G, Cornu S, Brus D, Breuning-Madsen H, Eckelmann W, Ernsten V, Gorny A, Jones RJA, King D, Langenkamp H, Loveland JP, Lobnik F, Magaldi D, Montanarella L, Utermann J, van Ranst E. Ispra, Italy.

Frink CR, 1996. A perspective on metals in soils. J.Soil Contam. 5(4), 329-359.

Gawlik BM, Langenkamp H, Jones RJA, Bidoglio G (Eds), 2003. Trace Element and Organic Carbon Contents of European Soils. Provisional Final Report. Results of a JRC-Co-ordinated survey on background values. EUR20xxxEN, 00pp. Office for Official Publications of the European Communities, Luxembourg.

ICP, 2003. Manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests. Part IIIa: Sampling and analysis of soil. ICP, International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests.

INRA, 2003. Information sur les éléments traces dans les sols en France. http://etm.orleans.inra.fr/webetm1.htm

Janssen RPT, Peijnenburg WJGM, Posthuma L, Van De, Hoop MAGT, 1997. Environ.Toxicol.Chem. 16 (12), 2470-2478.

Jones KC, Symon CJ, Johnston AE, 1987. Retrospective analysis of an archived soil collection. I. Metals. Sci.Total Environ. 61, 131-144.

Kabata-Pendias A, Pendias H, 1984. Trace elements is soils ands plants. CRC Press, Boca Raton , Florida, USA.

Kabata-Pendias A, Dudka S, Chlopecka A, Gawinowska T, 1984. Background levels and environmental influences on trace metals in soils of the temperate humid zone of Europe. In: Adriano DC (Ed.), Biogeochemistry of trace metals. Lewis Publishers,Boca Raton, Florida, USA.

Kim ND, Fergusson JE, 1991. Effectiveness of a commonly used sequential extraction technique in determining the speciation of cadmium in soils. Sci.Total Environ. 105, 191-209.

Klaine S.J., Cobb G.P., Dickerson R.L., Dixon K.R., Kendall R.J., Smith E.E. and K.R. Solomon. 1996. An ecological risk assessment for the use of the biocide, dibromonitrilopropionamide (DBNPA) in industrial cooling system. Environmental Toxicology and Chemistry 15, 21-30.

Kuusisto E, Mäkelä-Kurtto R, Tarvainen T, 1999. Heavy metals in arable soils in Finland. Proceedings of the Fourth Finnish Conference on Environmental Sciences: Environment, science, Technology and Policy, Tampere, May 21-22, 1999. p. 203-206.

LABO, 2003. Hintergrundwerte für anorganische und organische Stoffe in Böden. Bund-Länder-Arbeitsgemeinschaft Bodenschutz, 58p + Annexes (111 p)

McGrath SP, Loveland PJ, 1992. The Soil Geochemical Atlas of England and Wales. Blackie, Glasgow.

McGrath D, 1995. Organic micropollutants and trace element pollution of Irish soils. Sci.Total Environ. 164, 125-133.

Münch D, 1993. Concentration profiles of arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, vanadium and polynuclear aromatic hydrocarbons (PAH) in forest soil beside an urban road. Sci.Total Environ. 138, 47-55.

Räissanen ML, Kashulina G, Bogatyrev I, 1997. Mobility and retention of heavy metals, arsenic and sulphur in podzols at eight locations in Northern Finland and Norway and the western half of the Russian Kola Peninsula. J.Geochem.Expl. 59, 175-195.

Reimann C., 2003. "Agricultural soils in Northern Europe: an overview. Schweizerbart Publ., Germany, 279p.

Richardson GM, 2001. Critical review on natural global and regional emissions of six trace metals to the atmosphere. Risklogic Scientific Services, Inc. Final Report, prepared for the International Lead Zinc Research Organization (ILZRO), the International Copper Association (ICA) and the Nickel Producers Environmental Research Organisation (NiPERA), Final Report, 52 p.

Solomon K.R., Baker D.B., Richards P., Dixon K.R., Klaine S.J., La Point T.W., Kendall R.J., Giddings. J.M., Giesy J.P. and L.W.J. Hall. 1996. Ecological risk assessment of atrazine in North American surface waters. Environmental Toxicology and Chemistry 15:31-76.

Solomon K.R. and Chappel M.J., 1998. Triazine herbicides: Ecological risk assessment in surface waters. In: Ballantine L., Mc Farland J., Hackett D. (Eds), Triazine risk assessment. Washington DC/ American Chemical Society. p. 357-368.

Tack FM, Verloo, MG, 1995. Chemical speciation and fractionation in soil and sediment heavy metal analysis: a review. Intern. J. Environ.Anal. Chem. 59, 225-238.

Tack FMG, Verloo MG, Vanmechelen L, Van Ranst E, 1997. Baseline concentration levels of trace elements as a function of clay and organic carbon contents in soils in Flanders (Belgium). Sci.Total Environ. 201, 113-123.

Tack FMG, Verloo MG, 1999. Single extractions versus sequential extraction for the estimation of heavy metal fractions in reduced and oxidised dredged sediments. Chem.Spec.Bioavail. 11, 43-50.

Tessier A, Campbell PGC, Bisson M, 1979. Sequential extraction procedure for the speciation of particulate trace metals. Anal. Chem. 51, 844-851.Tjell JL, Hovmand MF, 1978. Metal concentrations in Danish arable soils. Acta Agric.Scand. 28, 81-84.

Ure AM, Berow ML, 1982. The elemental constituents of soils. In: Bowen HJM, Berrow ML, Burton JD, Cawse PA, Patterson DSP, Statham PJ, Ure AM (Eds.), Environmental Chemistry, Volume 2: a review of the literature published up to Mid-80. The Royal Society of Chemistry, Burlington House, London, pp. 1-+69 and 94-204.

Utermann J, Düwel O, Fuchs M, Gäbler H-E, Gehrt E, Hindel R, Schneider J, 1999. Methodische Anforderungen an die Flächenrepräsentanz von Hintergrundwerten in Oberböden. UBA-Forschungsbericht 297 71 010, UBA-FB 99-066. Texte 95-99, Umweltsbundesamt, Berlin.

Utermann J, Düwel O, Gäbler H-E, Hindel R, 2000. Beziehung zwischen Totalgehalten und königswasser-extrahierbaren Gehalten von Schwermetallen in Böden. In: Rosenkranz D, Bachmann G, Einsele G, Harress H-M (Eds.), Handbuch Bodenschutz, Kennziffer 1600 E. Schmidt-Verlag, Berlin, Germany.

Van Driel W, Smile KW, 1982. Heavy metal content of Dutch arable soils. Landwirtch.Forsch.Sonderh. 38, 305-313.

Wiklander L, Vahtras K, 1977. Solubility and uptake of heavy metals from a Swedish soil. Geoderma 19, 123-129.

6.1.9 References, Section 3.1, waste report

- Vangheluwe M., Versonnen B. & Verdonck F., EURAS, 2005. Ni Waste stream analysis and emission assessment. Study for NiPERA, 100p. **Appendix E.1**

Aalbers Th. G., De wilde P., Rood G., Vermij P., Saft R., Van De Beek A, Broekman H., Masereeuw M., Kamphuis C., Dekker P. and Valentijn E. (1996). Environmental quality of primary and secoondary construction materials in relation to re-use and protection of soil and surface water. RIVM report 771402007, 1996.

ADEME. 1993. La composition des ordures ménagères en France. Données et references. ADEME documentation, Angers, France.

Beker D. and Cornelissen A.A. 1999. Chemische analyse van huishoudelijk restafval. Resultaten 1994-1995. RIVM report 776221.

AMINAL (1994) Huisvuilverbranding in Vlaanderen. Het BMI betuur milieu-inspectie. D/1994/6137/42

Anthonissen I.H. and Meijer P.J. (1993) Informatiedocument AVI reststoffen, RIVM report N° 738902025. 33 p.

AOO, 2004. Emissiejaarrapportage 2004, gegevens Afvaloverlegorgaan

Argus (2000). The behaviour of PVC in landfill. Study for the European Commission DGXI.E3 by Argus in association with Prof. Spillmann, carl Bro (University Rostock) and Sigma Plan S.A., 82 p. + Annex

Assmuth T. (1992).Distribution and attenuation of hazardous substances in uncontrolled solid waste landfills. Waste Management and Research, 10, 235-255.

Assmuth T. and T. Strandberg (1993). Ground water contamination at Finnish landfills. Water, air and soil pollution 69, 179-199.

Avezzu F., Bissolotti G., Collivignarelli and A.V. Ghirardini (1995). Behaviour of heavy metals in activated sludge biological treatment of landfill leachate. Waste Management and Research, 13, 103-121.

Baccini P., Henseler G., Figi, R. and Belevi H. (1987). Water and element balances of municipal solid waste landfills.Waste Management & Research, 5, 483-499.

Beker D. and Cornelissen A.A. (1999). Chemische analyse van huishoudelijk restafval. Resultaten 1994-1995. RIVM report 776221.

Bernard J., H. Ole & V. Jürgen (2000). The influence of PVC on the quantity and hazardnousness of flue gas residues from incineration. Finol report.Bertin Technologies.

CBS (2002). Statline. Zuivering van Afvalwater. CBS Voorburg/Heerlen.

CEC, Commission of the European Communities. 2002. Draft proposal for a European Parliament and Council Directive on WEEE. Brussels, June 2002. http://europa.eu.int/eur-lex/en/com/pdf/2002/en_500PC0347_02.pdf

Dahm W., Kollbach St. and Gebel J. (1994). Sickerwasserreinigung: Stand der Technik 1993/1994; zukünftige entwicklungen, EnviroConsult GmbH, Neuruppin: EF-Verl. für Energie-und Umwelttechnic, 1994 ISBN 3-924511-79-9

Danish EPA (2002). Waste statistics, 2000.Orientering fra Miljostyrelsen Nr 1. 2002.

Defra. 2004. Review of environmental and health effects of waste management. Municipal solid waste and similar wastes. Department for Environment, Food and Rural Affairs (DEFRA), London, UK.

Doedens H. and Theilen U. (1992). Effluent requirements and related leachate treatment processes. In landfilling of waste: leachate. P. 417-428. Edited by Christensen T.H., Cossu R. and Stegmann R.

DTU (2001). Waste related emission scenarios for risk assessment of chemicals. A background document for revision of the EU Technical Guidance Document on risk assessment of new and existing substances.

Environment Agency (2001): Pollution inventory 2001 http:// www.environment-agency-gov/uk/business

Environment Agency (2002). Solid residues from municipal waste incinerators in England and Wales. Environment Agency, may 2002.

EC (1999). EC/31/1999 Council directive on the landfilling of waste

EC (2000). Council directive 2000/76/EC on the incineration of waste.

EEA (2000). Dangerous substances in waste. European Environment Agency, Technical report N° 38, 50 p.

Ehrig H.J. Quality and quantity of sanitary landfill leachate (1983). Waste Management & Research, 1, 53-68.

Ehrig H.J. (1988).Water and element balances of lndfills. In : Baccini, P. (ed) : The landfill, reactor and final storage. Lecture Notes in Earth Sciences, 20, 83-115, Springer Verlag.

EREF (1999). Life Cycle Inventory of a Modern Municipal Solid Waste Landfill. USA Washington Environmental Research and Education Foundation. 403 p.

ETWC (2002) Wastebase, European Topic Centre on Waste, http://wastebase.eionet.eu.int.

EUROSTAT. 2003. Waste generated and treated in Europe. Data 1990-2001. Edited by Jordan and Heidorn. Office for Official Publications of the European Communities, Luxembourg.

Finnveden G. (1996). Solid waste treatment within the framework of Life Cycle Assessment : metals in municipal solid waste landfills. int. J. LCA, 1 (2), 74-78.

Flyhammar P. (1995). Analysis of the cadmiumflux in Sweden with special emphasis on landfill leachate.

J. Environ. Qual, 24, 612-621.

Flyhammar P., F. Tamaddon and L. Bengtsson (1998). Heavy metals in a municipal solid waste deposition cell. Waste Management Research, 16 (5), 403-410.

Flyhammer P. and K. Hakansson (1999). The release of heavy metals in stabilsed MSW by oxidation. The Science of the total environment. 243/244, 291-303

Förstner U. and G. Hirschman (1997). Langfristiges deponieverhalten von müllverbrennungsschlacken. UBA 1460799A.

Gerlagh T., Verhagen H., Geurts O., Miedema H. and Van Seters A. (2002). Afvalverwerking in Nederland, gegevens 2001. VVAV02004IR.R

Hamel E.(2001) Untersuchungen zum verhalten von schwermetallen in kommunalen kläranlagen unter besonderer berücksichtigung der metallanreicherung an belebtsschlämmen. Dissertation.

Hjelmar O., Mikkel Johanssen L., Knox K., Ehrig H.J., Flyvberg J., Winther P. and Christensen T.H.. (1994). Management and composition of leachate from landfills. Report for DGXI Waste 92, B4-3040/013665/92. Prepared by Water Quality Institute and Carl Bro Environment. Final report september 1994.

ISWA (2002). Energy from waste. State of the art report, statistics 4. Edition January 2002. Working group on Thermal treatment of Waste. Published by The International Solid Waste Association. 156 p.

ISSEP (1999). Reseau de controle pour l'etude et la characterisation des emissions atmospheriques des installation de valorisation de dechets en region wallone. http:// mrw.wallonie.be/dgrne/data/air/valorisation/reseau_inicnerateurs

Jacobs A, L. De Bock & R.. Dijkmans (2001). Best Beschikbare Technieken (BBT) voor asfaltcentrales, VITO

Jockel W. and Hartjes J. (1995). Die Entwicklung der Schwermetallemissionen in der Bundesrepublik. Deutschland von 1985 bis 1995.

Juniper (1997). European Energy from Waste Coalition. Energy from waste plants: databook of European sites. Juniper Consultancy servises, November 1997.

Kerndorff H., R. Schleyer, J. Arneth, T. Struppe and G. Milde (1990). Entwicklung von methoden und massstäben zur standardisierten bewertung von altablagerungsstandorten und kontaminierten betriebsgeländen insbesondere hinsichtlich ihrer grundwasservereinigungspotentiale,. Abschlussbericht. Teil 1. Institut für wasser, boden- und lufthygiene des bundesgesundheitsamtes.

Kjeldsen P and M. Christophersen (2001). Composition of leachate from old landfill in Denmark. Waste Management Research, 19, 249-256.

Kjeldsen, P. & Christensen, T.H. (2001): A simple model for the distribution and fate of organic chemicals in a landfill: MOCLA. *Waste Management & Research*, 19 (3), 201-216.

Krümpelbeck I. (1999). Untersuchungen zum langfristigen verhalten von siedlungsabfalldeponien. Dissertation Bergische Universität, Wuppertal.

Lemann M., Walder R. and Schwyn A.(1995). Heavy metals in municipal solid waste residues. Journal of Power Sources 57, 55-59.

Lipor (2002) Internal report.

Looser M. (1996). Méthode de detection et de caractérisation de pollutions du sous-sol par les sites contaminés aà l'aide des traces inorganiques. Thèse, Ecole Polytechnique Fédérale de Lausanne.

Looser M., A. Parriaux and M. Bensimon (1996) . Landfill underground pollution detection and characterization using inorganic traces. Wat.Res., 33 (17), 3609-3616.

Looser M-O. 1997. Méthode de detection et de caractérisation de pollutions du sous-sol par les sites contaminés à l'aide des traces inorganiques. Ecole Polytechnique Fédérale de Lausanne (EPFL). Lausanne, Switzerland.

Mast P-G. 1998. Einfluss der abfallzusammensetzung auf schadstoffgehalt und –menge der berbrennungsrückstände. Phase II. TauwUmwelt GmbH Germany.

Maystre L.Y., Duflon V., Diserens T., Leroy D., Simos J. & Viret F. 1994. Déchets urbains. Nature et caractérisation. Collection Gérer L'environnement. Presses polytechniques et universitaires romandes

Mc Mellin G. (2002) Personal communication 02-07-2002, Environment Agency.

Mersiowsky I. (2001) Contribution of post-consumer PVC products to lead inventory in landfilled waste. Report TUHH Technology GmbH.

Mersiowsky I., 2001. Contribution of post-consumer PVC products to lead inventory in landfilled waste. Substance Flow Analysis report commissioned by the European Council of Vinyl Manufacturers (ECVM) and the European Stabilisers Producers Association (ESPA).

Milieumonitor (2002). Datawarehouse Emissieregistratie Nederland: emissies nikkel in 1999.

MMA (2002). Inventario Nacional de Contaminantes Atmosféricos. Ministreio de Medio Ambiente

NETC (1995). National Household Waste Analysis Project, 1995 Phase 2, vol. 3. Chemical analysis data. Report No CWM/087/94, Wastes technical division, Department of the environment, HMSO, London.

NiDI [Nickel Development Institute]. (2001a). End Use of Nickel 1998: Amounts of nickel used in Western Europe for the manufacture of products in different sectors (by material type). May 2001..

NiDI [Nickel Development Institute] (2001b): End Uses of Nickel: Pattern of use by material type and assessment of consumer exposure. September 2001.

Nielsen P.H. and Hausschild M. (1998). Product specific emissions from Municipal Solid Waste Landfills. Part 1 : landfill model. int. J. LCA, 3 (3), 158-168.

Nielsen P.H., Exner S., Jorgensen, A.M and Hauschild M.(1998) Product specific emissions from Municipal Solid Waste Landfills. Part 2: Presentation and verification of the computer tool LCA-LAND. int. J. LCA, 3 (4), 225-236.

OECD (1999). OECD Environmental Data Compendium 1999.Organisation for Economic Coöperation and Development, Paris, France. 328 p.

Otte F.P. (1995). Analysis of metals and calorific value in components from household waste, 1988-1992 (including the results from 1986 and 1987. RIVM report 776201024

Papini M.P., M. Majone and E. Rolle (2001). Kaolinite sorption of Cd, Ni and Cu from landfill leachates: influence of leachate composition. Water Science and Technology, 44 (2-3), 343-350.

Pariser (2002). Alloy metals and steel market research. Research by Heinz H. Pariser carried out for NiDI.

Prudent P., Domeizel M. & Massiani C. 1996. Chemical sequential extraction as decision-making tool: application to municipal solid waste and its individual constituents. The Science of the Total Environment 178, 55-61.

Qiang X., Koerner R.M and D.H. Gray (2002). Geotechnical aspects of landfill design and construction. Prentice Hall. 710 p.

Reimann D.O. (1989). Heavy metals in domestic refuse and their distribution in incinerator reidues. Waste Management & Research, 7, 57-62

Reimann (2002a). Schadstofffrachten von restabfällen am beispiel des MHKW Bamberg, March 2002.

Reimann D.O (2002b). Experiences with TMT 15 for mercury minimization in waste water from waste incineration. Veranstaltungsort Hydroline Spa/Eigenmann & Veronelli Spa. Rho (Milano) 28 Februari 2002.

Rentz. O., Sasse H., Karl U., Schleef H. and Dorn R. (1997). Emission control at stationary sources in the Federal Republic of Germany. Voll II. Heavy Metal Emission Control. UBA TEXTE 67/97.

RIVM/LAE (2000). Monitoring prioritaire afvalstoffen, gegevens 1998

Robinson H. (1995). A review of the composition of leachates from domestic wastes in landfill sites. Report prepared for the UK Department of the Environment.

Rousseaux P, Navarro A. & Vermande P. 1989. Distribution of seven heavy metals in European household waste components. In Proc. Int. conf. heay metals in the Environ., Geneva. Ed. Vernet, J.-P. v.2, 87-90.

RVF (2002). Website Swedish Waste Management. http://www.rvf.se

Schroeder, P.R., N.M. Aziz, C.M. Lloyd and P. Zappi, 1994a.The hydrologic evaluation of landfill performance (HELP model). User's guide for version 3. EPA/600/R-94/168a, September 1994, U.S. Environmental Protection Agency Office of Research and Development, Washington, DC.

Schroeder, P.R., T.S. Dozier, P. Zappi, B.M McEnroe, J.W. Sjöstrom and R.L Peyton, 1994b.The hydrologic evaluation of landfill performance (HELP model). Engineering documentation for version 3. EPA/600/R-94/168b, September 1994, U.S. Environmental Protection Agency Office of Research and Development, Washington, DC.

Schuster (1999). Waste incineration plants in Austria. Greenpeace.

SFSP (1999). L'incinération des déchets et la santé publique: bilan des connaissances récents et évaluation du risque. Société Française de Santé Publique, ISBN 2-911489-07-1

Stubenvoll J., S. Böhmer and I. Szednyj (2002). State of the art for waste incinerator plants. Fedral minisry of agriculture and forestry, environment and water management, Austria.

TGD (1996). Technical Guidance Document in support of Commision Directive 93/67/EEC on Risk Assessment for New Notified Substances and Commission Regulation (EC) N° 1488/94 on Risk Assessment for Existing Substances. ISBN 92-827-8012-0, Luxembourg.

TRAR (2003). Draft targeted risk assessment report: Cadmium (oxide)as used in batteries, 17 february 2003.

Umweltbundesamt 2001. Daten zur Umwelt. Der Zustand der Umwelt in Deutschland 2000. Erich Schmidt Verlag, Berlin. ISBN 3-503-05974-1 (CD-ROM).

US EPA (1991). Methodology for assessing environmental releases of and exosure to municipal solid waste combustor residuals, US Environmental Protection Agency, Report EPA/600/8-91/031

Van Der Poel P. (1999). Supplement to the Uniform Sysyem for the Evaluation of Substances (USES). Emission scenarios for waste treatment (elaborated for biocides). RIVM report 601450 003.

Van De Wijdeven (1991). Beoordelingsstudie inertisatie van reststoffen van afvalverbrandingsinstallaties en zuiveringsslibverbrandingsas. NOvem report 90369.

VMM (2001). Vlaamse Milieumaatschappij, Inventarisatie Milieujaarverslagen huishoudelijke verbrandingsinstallaties.

Wesselink (1995).Relatie uitlooggedrag laboratorium-praktijk bij wegenbouwkundige projecten. Geo-chemische modellering uitlooggedrag vliegas Vondelingenweg en AVI-bodemas Coloradoweg, Rotterdam. RIVM report 771402016.

Williams P.T. (1998). Waste treatment and disposal. John Wiley and Sons. 407 p.

6.2 REFERENCES, SECTION 3.2

6.2.1 References, Section 3.2, Aquatic Effects Assessment

Antunes, P. 2007. Testing the Toxicity of Ni to *Lemna minor* in natural waters and standard test media. Draft Final Report. Prepared by StanTec, Ltd., for NiPERA. June, 2007. 69 p.

Biesinger KE, Christensen GM. 1972. Effects of various metals on survival, growth, reproduction and metabolism of *Daphnia magna*. J.Fish Res. Board Canada 29 (12): 1691-1700.

Birge WJ, Black JA. 1980. Aquatic toxicology of nickel. In: Nriagu JO (ed.): Nickel in the Environment. John Wiley and Sons. New York, Chichester, Brisbane, Toronto.pp.349-366.

Birge WJ, Black JA, Hobson JF, Westerman AG, Short TM. 1984. Toxicological studies on aquatic contaminants originating from coal production and utilisation: The induction of tolerance to silver in laboratory populations of fish and the chronic toxicity of nickel to fish early life stages. Research Report no. 151. U.S. Geological Survey, Reston, VA.

Blaylock B.G. and M.L. Franck. 1979. A comparison of the toxicity of nickel to the developing eggs and larvae of carp (Cyprinus carpio). Bull. Environ. Contam., 21:604-611.

Borgmann U., R. Néron and W.P. Norwood. 2001. Quantification of bioavailable nickel in sediments and toxic thresholds to Hyalella azteca. Environmental Pollution, 111:189-198.

Borgmann, U., C.R. Janssen, R.J.P. Blust, K.V. Brix, R.L. Dwyer, R.J. Erickson, L. Hare, S.N. Luoma, P.R. Paquin, C.A. Roberts, and W-X Wang. 2005. Incorporation of dietborne metals exposure into regulatory frameworks. In: Meyer, J.S., W.J. Adams, K. Brix, S.N. Luoma, D.R. Mount, W.A. Stubblefield, and C.M. Wood, editors. Toxicity of Dietborne Metals to Aquatic Organisms. Pensacola, FL: SETAC Press. p. 153-190.

Brix KV, Keithly J, DeForest DK. 2003. Acute and chronic toxicity of nickel to rainbow trout (Oncorhynchus mykiss). EcoTox, Oregon prepared for NiPERA, Received Jan 2003.

Deleted: ¶

Burton GA, LH Nguyen, C. Janssen, R. Baudo, M. Beltrami. 2005b. Evaluation of Nickel Effect Levels in Freshwater Sediments. Final report. Prepared for NiPERA.

Campbell P.G.C. (1995). Interactions between trace metals and aquatic organisms: a critique of the free-ion activity model. pp. 45-102. In: Metal Speciation and Bioavailability in Aquatic Systems. Tessier A. and Turner D.P. (eds.). John Wiley and Sons, UK.

Cullen A.C. & Frey H.C., 1999. Probabilistic techniques in exposure assessment. A handbook for dealing with variability and uncertainty in models and inputs. Plenum Press, New York & London. 335 p

Dave G and Xiu R. 1991. Toxicity of mercury, copper, nickel, lead, and cobalt to embryos and larvae of Zebrafish, Brachydanio rerio. Arch. Environ. Contam. Toxicol. 21: 126-134

De Schamphelaere et al. 2006. Bioavailability of Nickel in sediments. University of Ghent, 2006.

Deleebeeck, De Schamphelaere, Heijerick, Bossuyt & Janssen. 2005. Development and validation of biotic ligand models for predicting nickel toxicity to fish, daphnids and algae. University of Ghent. 150 p.

Deleebeeck, De Schamphelaere, Muyssen, De Laender & Janssen. 2006 Ni toxicity to soft vs. hard water organisms: a comparison of sensitivity and bioavailability. University of Ghent.

De Schamphelaere, K.A.C., Janssen, C.R., 2002. A biotic ligand model predicting acute copper toxicity for *Daphnia magna*: effects of calcium, magnesium, sodium and pH. Environmental Science and Technology 36: 48-54.

De Schamphelaere K,,Van Laer L, Deleebeeck N, Muyssen B, Degryse F, Smolders E, and C Janssen. 2006. Nickel speciation and ecotoxicity in European natural surface waters: development, refinement and validation of bioavailability models. University of Ghent. 125 p.

Dueri, S., Zaldiver, J.M., and Olivella, A. 2005. Dynamic modelling of the fate of DDT in Lake Maggiore: Preliminary Results. Institute for Environment and Sustainability. Inland and Marin Waters Unit. Joint Research Center of the European Chemicals Bureau, Ispra, Italy. Report # EUR 21663 EN. 33 pp.

Enserink, E.L., Maas-Diepeveen J.L. and C.J. Van Leeuwen. 1991. Combined effects of metals; an ecotoxicological evaluation. Wat. Res., 25, 679-687

Fort et al. 2004. Embryo-larval development toxicity of nickel to selected amphibian species. Performed by Fort Environmental Labaoratories, prepared for NiPERA.

Grande M. and Andersen S. 1983. Lethal effects of hexavalent chromium, lead and nickel on young stages of Atlantic salmon (*Salmo salar* L.) in soft water. Vatten 39(4): 405-416

Herkovits J, Perez-Coll CS, Herkovits FD. 2000. Evaluation of nickel-zinc interactions by means of bioassays with amphibian embryos. Ecotoxicol. Environ. Safety 45: 266-273.

Hoang, T.C., Tomasso, J.R., Klaine, S.J., 2004. Influence of water quality and age on nickel toxicity to fathead minnows (*Pimephales promelas*). Environmental Toxicology and Chemistry 23: 86-92.

Hopfer SM, Plowman MC, Sweeney KR, Bantle JA, Sunderman FW. 1991. Teratogenicity of Ni2+ in *Xenopus laevis*, assayed by the FETAX procedure. Biol. Trace Elem. Res. 29: 203-215.

ISO, 2004. Working draft, Water Quality- Guidance document on the statistical analysis of ecotoxicity data, March 2004. ISO/CD20281.

Janssen. 1993. The effect of nickel chloride on the growth of the unicellular green alga (*Selenastrum capricornutum*). Janssen study no. AASc/0007. Janssen Pharmaceutica. Belgium. (NiPERA document, internal report)

Janssen. 1993. The effect of nickel sulfate on the growth of the unicellular green alga (*Selenastrum capricornutum*). Janssen study no. AASc/0008. Janssen Pharmaceutica. Belgium. (NiPERA document, internal report)

Keithly, J, Brooker JA, DeForest DK, Brix KV, Wu BK. 2004. Acute and chronic toxicity of nickel to cladoceran (*Ceriodaphnia dubia*) and amphipod (*Hyalella azteca*). Prepared by Wirtz et al. and EcoTox for NiPERA, received Dec 2002.

Klaine S.J. and Knuteson. 2003. Toxicity of Nickel to duckweeds. Report prepared by the Clemson Institute of Environmental Toxicology, Clemson University, Pendleton.

Kszos LA, Stewart AJ, Taylor PA. 1992. An evaluation of nickel toxicity to *Ceriodaphnia dubia* and *Daphnia magna* in a contaminated stream and in laboratory tests. Environ. Toxicol. Chem. 11(7):1001-1012

Kuhn R, Pattard M, Pernak K-D, Winter A. 1989. Results of the harmful effects of water pollutants to *Daphnia magna* in the 21 day reproduction test. Water Res. 23(4): 501-510

Lee, J.S, B.G. Lee, S.N. Luoma and H. Yoo, 2004. Importance of equilibration time in the partitioning and toxicity of zinc in spiked sediment bioassays. Environmental Toxicology and Chemistry, 23 (N°1), 65-71.

Lind D, Alto K, Chatterton S. 1978. Regional Copper-Nickel Study. Draft Report, Minnesota Environmental Quality Board St. Paul, MN:54 p.

Lock, K., Van Eeckhout, H., De Schamphelaere, K.A.C., Criel, P., Janssen, C.R. 2005. Development of a biotic ligand model (BLM) predicting nickel toxicity to barley (Hordeum vulgare)

McCrady, J.K. and G.A. Chapman. 1979. Determination of copper complexing capacity of natural river water, well water and artificially reconstituted water. Water Res. 13:141-150.

Meyer, J.S., Santore, R.C., Bobbitt, J.P., Debrey, L.D., Boese, C.J., Paquin, P.R., Allen, H.E., Bergman, H.L., Di Toro, D.M., 1999. Binding of nickel and copper to fish gills predicts toxicity when hardness varies, but free-ion activity does not. Environmental Science and Technology 33: 913-916.

Milani D., T.B. Reynoldson, U. Borgmann and J. Kolasa, 2003. The relative sensitivity of four benthic invertebrates to metals in spiked sediment exposures and application to contaminated field sediment.

Munzinger A. 1990. Effects of nickel on Daphnia magna during chronic exposure and alterations in the toxicity to generations pre-exposed to nickel. Water Research, 24(7): 845-852.

Munzinger A. 1994. The influence of nickel on population dynamics and on some demographic parameters of Daphnia magna. Hydrobiologia 277(2): 107-120.

Nebeker AV, Savonen C, Baker RJ, McCrady JK. 1984. Effects of copper, nickel and zink on the life cycle of the caddishfly *Clistoronia magnifica* (Limnephilidae). Environ. Toxicol. Chem. 3: 645-649.

Nebeker AV, Savonen C, Stevens DG. 1985. Sensitivity of rainbow trout early life stages to nickel chloride. Environ. Toxicol. Chem. 4(2): 233-239.

Nebeker AV, Stinchfield A, Savonen C, Chapman GA. 1986. Effects of copper, nickel and zinc on three species of Oregon freshwater snails. Environ. Toxicol. Chem. 5(9): 807-811.

Pagenkopf, G.K., 1983. Gill surface interaction model for trace-metal toxicity to fishes: role of complexation, pH, and water hardness. Environmental Science and Technology 17: 342-347.

Pane, E.F., Smith, C., McGeer, J.C., Wood, C.M., 2003a. Mechanisms of acute and chronic waterborne nickel toxicity in the freshwater cladoceran, *Daphnia magna*. Environmental Science and Technology 37(19): 4382-4389.

Pane, E.F., Richards, J.G., Wood, C.M., 2003b. Acute waterborne nickel toxicity in the rainbow trout (*Oncorhynchus mykiss*) occurs by a respiratory rather than ionoregulatory mechanism. Aquatic Toxicology 63: 65-82.

Pane, E.F., Haque, A., Wood, C.M., 2004a. Mechanistic analysis of acute, Ni-induced respiratory toxicity in the rainbow trout (*Oncorhynchus mykiss*): an exclusively branchial phenomenon. Aquatic Toxicology 69(1): 11-24.

Pane, E.F., Haqua, A., Goss, G.G., Wood, C.M., 2004b. The physiological consequences of exposure to chronic, sublethal waterborne nickel in rainbow trout (*Oncorhynchus mykiss*): exercise vs resting physiology. The Journal of Experimental Biology 207 (7): 1249-1261.

Pickering QH. 1974. Chronic toxicity of nickel to the fathead minnow. J. Water Pollut. Control Fed. 46: 760-765

Powlesland C, George IC. 1986. Acute and chronic toxicity of nickel to larvae of *Chironomus riparis* (Meigen). Environ. Pollut. (Series A) 42(1): 47-64.

Pyle, G.G., Swanson, S.M., Lehmkuhl, D.M., 2002. The influence of water hardness, pH, and suspended solids on nickel toxicity to larval fathead minnows (Pimephales promelas). Water, Air, and Soil Pollution 133: 215-226.

Santiago-Fandino VJR. 1983. The Effects of Nickel and Cadmium on the Growth Rate of *Hydra littoralis* and an Assessment of the Rate of Uptake of 63Ni and 14C by the Same Organism. Water Res. 17(8):917-923

Santore R.C., Mathew R., Paquin R.P. and DiToro D. (2002). Application of the biotic ligand model to predicting zinc toxicity to rainbow trout, fathead minnow and *Daphnia magna* . Comparative Biochemistry and Physiology, C133, 271-285.

Stubblefield WA and E Van Genderen. 2007. Validation of nickel Biotic Ligand Model predictions for selected non-standard organisms. Draft Final Report. Prepared by Parametrix, Inc. Corvalis, OR, USA for NiPERA. 635 p.

Schubauer-Berigan, M.K., Dierkes, J.R., Monson, P.D., Ankley, G.T., 1993. pH-dependent toxicity of Cd, Cu, Ni, Pb and Zn to Ceriodaphnia dubia, Pimephales promelas, Hyalella azteca and Lumbriculus variegates. Environmental Toxicology and Chemistry 12: 1261-1266.

Tessier, A., and P.G.C. Campbell. 1987. Partitioning of trace metals in sediment: Relationships with bioavailability. Hydrobiologia. 149: 43-52.

University of Ghent, 2005. Development and validation of biotic ligand models for predicting nickel toxicity to fish, daphnids and algae. Research project funded by NiPERA. 150 p.

University of Ghent, 2006. Ni toxicity to soft vs hard water organisms: a comparison of sensitivity and bioavailability. Research project funded by NiPERA. 16 p.

van Frankenhuyzen K and Geen GH. 1987. Effects of low pH and nickel on growth and survival of the shredding caddisfly *Clistoronia magnifica* (Limnephilidae). Can. J. Zool 65: 1729-1732.

Van Laer L., E. Smolders, F. Degryse, K. De Schamphelaere, C. Janssen. 2006. Speciation of nickel in surface waters measured with the Donnan membrane technique. Analytica Chemica Acta. In Press.

Vandegehuchte MB, De Schamphelaere KAC, Roman YE, Nguyen LTH, Heijerick DG, Janssen CR. 2006. Bioavailability and ecotoxicity of nickel in sediments. Final report, 2 March 2006. Report prepared for NiPERA.

Wang, F., R. R. Goulet and P.M. Chapman. 2004. Testing sediment biological effects with the freshwater amphipod Hyalella azteca: the gap between laboratory and nature. Chemosphere, 57:1713-1724.

Wirtz J.R., W.A. Stubblefield, K.A.A.C. De Schamphelaere, R.B. Naddy, L.S. Ortego and C. E. Schlekat. 2004. Effect of water quality parameters on chronic nickel toxicity to Ceriodaphnia dubia.

Zuurdeeg BW, Van Enk R, Vriend S, Bussink R, Molenaar A, Reijniewicz I, 1992 (in dutch). Natuurlijke achtergrondgehalten van zware metalen en enkele andere sporenelementen in Nederlands oppervlaktewater. Studie in opdracht van VROM, Geochem Research, Utrecht, 100p.

6.2.2 References, Section 3.2, Marine Effects

Bielmeyer, GK, Brix KV, Capo TR, and Grossel M. 2005. The effects of metals on embryo-larval and adult life stages of the sea urchin, *Diadema antillarum*. *Aquat. Toxicol*. 74: 254-263.

Chiappone, M, DW Swanson, SW Miller, and SG Smith. 2002. Large-scale surveys on the Florida Reef Tract indicate poor recovery of the long-spined sea urchin *Diadema antillarum*. *Coral Reefs* 21: 155–159.

Davies, A.G. 1976. An assessment of the basis of mercury tolerance in *Dunaliella tertiolecta*. *J. Mar. Biol. Assoc*. U.K. 56: 39-57

Fisher, N.S., M. Bohe, and J.-L. Teyssie. 1984. Accumulation and toxicity of Cd, Zn, Ag, and Hg in four marine phytoplankters. *Mar. Ecol. Prog. Ser*. 18: 201-213Gentile JH, Gentile SM, Hairston NG, Sullivan BK. 1982. The use of life-tables for evaluating the chronic toxicity of pollutants to *Mysidopsis bahia*. *Hydrobiologia* 93(1-2): 179-182

Golder Associates, Ltd. 2007. Toxicity of nickel to giant kelp (*Macrocystis pyrifera*) and sheepshead minnow (*Cyprinodon variegatus*). Final Report. Submitted to Nickel Producers Environmental Research Association. 18 pages plus 3 Appendixes.

Hunt, JW, Anderson BS, Phillips BM, Tjeerdema RS, Puckett HM, Stephenson M, Tucker DW, and Watson D. 2002. Chronic toxicity of nickel to marine organisms: Implications for water quality criteria. *Environ. Toxicol. Chem*. 21: 2423-2430.

Lessios, HA. 1988. Population dynamics of *Diadema antillarum* (Echinodermata: Echinoidea) following mass mortality in Panama. *Mar Biol* 99:515–526

Lessios, HA. 2005. Diadema antillarum populations in Panama twenty years following mass mortality. *Coral Reefs* 24: 125-127.

Mortimer MR and Miller GJ. 1994. Susceptibility of larval and juvenile instars of the Sand crab, *Portunus pelagicus* (L.), to sea water contaminated by chromium, nickel or copper. *Aust. J. Mar. Freshwater Res*. 45(7): 1107-1121

Novelli, AA, Losso, C, Ghetti, PF, Ghirardini, AF. 2003. Toxicity of heavy metals using sperm cell and embryo toxicity bioassays with *Paracentrotus lividus* (Echindermata: Echoidea): Comparisons with exposure concentrations in the lagoon of Venice, Italy. Environ. Toxicol. Chem. 22:1295–1301.

Parametrix, Inc. 2007a. Chronic reproduction test with the Red Macroalgae, *Champia parvula*, to nickel chloride hexahydrate. Parametrix Data Report. Submitted to Nickel Producers Environmental Research Association. March 2007.

Parametrix, Inc. 2007b. Toxicity of nickel to *Skelatonema costatum* in five natural waters. Parametrix Data Report. Submitted to Nickel Producers Environmental Research Association. April 2007.

Parametrix, Inc. 2007c. Toxicity of nickel to *Dunaliella tertiolecta*s. Parametrix Data Report. Submitted to Nickel Producers Environmental Research Association. April 2007.

Parametrix, Inc. 2007d. Toxicity of nickel to the sand dollar, *Dendraster excentricus*, and the purple sea urchin, *Strongylocentrotus purpuratus*. Parametrix Data Report. Submitted to Nickel Producers Environmental Research Association. March 2007.

Parametrix, Inc. 2007e. Toxicity of nickel to the mussel, *Mytilis galloprovincialis*, in five natural waters. Parametrix Data Report. Submitted to Nickel Producers Environmental Research Association. March 2007.

Parametrix, Inc. 2007f. Toxicity of nickel to *Neanthes arenaceodentata*. Parametrix Data Report. Submitted to Nickel Producers Environmental Research Association. May 2007.

Parametrix, Inc. 2007g. Toxicity of nickel to *Crassostrea gigas*. Parametrix Data Report. Submitted to Nickel Producers Environmental Research Association. September 2007.

Petrich SM and Reish DJ. 1979. Effects of aluminum and nickel on survival and reproduction in polychaetous annelids. *Bull. Environ. Contam. Toxicol.* 23(4/5): 698-702 .

6.2.3 References, Section 3.2, Terrestrial Effects

Aldenberg, T. and Slob, W. 1993. Confidence limits for hazardous concentrations based on logistically distributed NOEC toxicity data, *Ecotoxicology and Environmental Safety* 25:48-63.

Aggangan, N. S., Dell, B. and Malajczuk, N. (1998). Effects of chromium and nickel on growth of the ectomycorrhizal fungus Pisolithus and formation of ectomycorrhizas on Eucalyptus urophylla S.T. Blake. Geoderma, 84, 15-27.

Ahonen-Jonnarth, U. and Finlay, R. D. (2001). Effects of elevated nickel and cadmium concentrations on growth and nutrient uptake of mycorrhizal and non-mycorrhizal Pinus sylvestris seedlings. Plant and Soil, 236, 129- 138.

Ahonen-Jonnarth et al. 2004. Effects of Nickel and Copper on Growth and Mycorrhiza of Scots Pine Seedlings inoculated with Gremmeniella abietina. Forest Pathology 34: 337-348

Aldenberg, T. and Slob, W. 1993. Confidence limits for hazardous concentrations based on logistically distributed NOEC toxicity data, Ecotoxicology and Environmental Safety 25:48-63.

Al-Khafaji, A. A. and Tabatabai, M. A. (1979). Effects of trace elements on arylsulfatase activity in soils. Soil Science, 127(3), 129-133.

Allinson, D. W. and Dzialo, C. (1981). The influence of lead, cadmium, and nickel on the growth of ryegrass and oats. Plant and Soil, 62, 81-89.

Association of American Plant Food Control Officials. (2005) Model for fertilizer regulation in North America. http://www.aapfco.org/aapfcorules.html#1 (December 20, 2005)

Atta-Aly, M. A. (1999). Effect of nickel addition on the yield and quality of parsley leaves. Scientia Horticulturae, 82, 9-24.

Babich, H. and Stotzky, G. (1982a). Nickel toxicity to fungi: influence of environmental factors. Ecotoxicology and Environmental Safety, 6, 577-589.

Babich, H. and Stotzky, G. (1982b). Toxicity of nickel to microorganisms in soil: influence of some physiochemical characteristics. Environmental Pollution, 29, 303-315.

Bai, C., Reilly, C.C., and Wood, B.W. (2006). Nickel deficiency disrupts metabolism of ureides, amono acids, and organic acids of young pecen foliage. Plant Physiology, 140, 433-443.

Beck, T. (1981). The toxic effects of heavy metals, commonly found in urban wastes on the soil microflora. Z. Pflanzenernaehr. Bodenk, 144, 613-627.

Berrow, M. L. and Reaves, G. A. (1986). Total chromium and nickel contents of Scottish soils. Geoderma, 37, 15-27.

Berry, W. and Wallace, A. (1989). Interaction of the yield response surface of lettuce with high and toxic concentrations of zinc and nickel. Soil Science, 147(6), 398- 400.

Bhuiya, M. R. H. and Cornfield, A. H. (1972). Effects of addition of 1000ppm Cu, Ni, Pb and Zn on carbon dioxide release during incubation of soil alone and after treatment with straw. Environmental Pollution, 3, 173-177.

Bingham, F. T., Page, A. L., Mitchell, G. A. and Strong, J. E. (1979). Effects of liming an acid soil amended with sewage sludge enriched with Cd, Cu, Ni, and Zn on yield and Cd content of wheat grain. Journal of Environmental Quality, 8(2), 202-207.

Bongers, M., Rusch, B. and Van Gestel, C.A.M. 2004. The effect of counterion and percolation on the toxicity of lead for the springtail Folsomia candida in the soil. Environmental Toxicology and Chemistry, 23: 195-199

Boyd and Williams. 2003. Availability of Metals to the Nematode Caenorhabditis elegans: Toxicity based on Total Concentrations in Soil and Extracted Fractions. Environ Toxicol Chem 22: 1100-1106.

Bremner, J. M. and Douglas, L. A. (1971). Inhibition of urease activity in soils. Soil Biology and Biochemistry, 3, 297-307.

Brown. 2004. The Differential Effects of Nickel on 4 Strains of the Nematode, Caenorhabditis elegans. BIOS. 75: 95-102.

Bruemmer GH, Gerth J, Tiller KG (1988). Reaction kinetics of the adsorption and desorption of nickel, zinc and cadmium by goethite. I. Adsorption and diffusion of metals. Journal of Soil Science 39:37-52.

Burd, G. I., Dixon, D. G. and Glick, B. R. (1998). A plant growth-promoting bacterium that decreases nickel toxicity in seedlings. Applied and Environmental Microbiology, 64(10), 3663-3668.

Chander, K. and Brookes, P. C. (1991). Effects of heavy metals from past applications of sewage sludge on microbial biomass and organic matter accumulation in a sandy loam and silty loam UK soil. Soil Biology and Biochemistry, 23(10), 927-932.

Chaudri, A. M., McGrath, S. P. and Giller, K. E. (1992). Survival of the indigenous poputlation of rhizobium leguminosarum biovar trifolii in soil spiked with Cd, Zn, Cu and Ni salts. Soil Biology and Biochemistry, 24(7), 625-632.

Cornfield, A. H. (1977). Effects of addition of 12 metals on carbon dioxide release during incubation of an acid sandy soil. Geoderma, 19, 199-203.

Dahiya, D. J., Singh, J. P. and Kumar, V. (1994). Nitrogen uptake in wheat as influenced by the presence of nickel. Arid Soil Research and Rehabilitation, 8, 51-58.

Dang, Y. P., Chhabra, R. and Verma, K. S. (1990). Effect of Cd, Ni, Pb and Zn on growth and chemical composition of onion and fenugreek. Communications in Soil Science and Plant Anaylsis, 21(9&10), 717-735.

De Catanzaro, J. B. and Hutchinson, T. C. (1985). Effects of nickel addition on nitrogen mineralization, nitrification, and nitrogen leaching in some boreal forest soils. Water, Air and Soil Pollution, 24, 153-164.

de Haan, S., Rethfeld, H. and van Driel, W. (1985). Acceptable levels of heavy metals (Cd, Cr, Cu, Ni, Pb, Zn) in soils, depending on their clay and humus content and cation-exchange capacity. Haren: Instituut voor Bodemvruchtbaarheid.

Deng, S. P. and Tabatabai, M. A. (1995). Cellulase activity of soils: effect of trace elements. Soil Biology and Biochemistry, 27(7), 977-979.

Dixon, R. K. (1988). Response to ectomycorrhizal Quercus rubra to soil cadmium, nickel and lead. Soil Biology Biochemistry, 20(4), 555-559.

Doelman, P. and Haanstra, L. (1984). Short-term and long-term effects of cadmium, chromium, copper, nickel, lead and zinc on soil microbial respiration in relation to abiotic soil factors. Plant and Soil, 79, 317- 327.

Doelman, P. and Haanstra, L. (1986). Short- and long-term effects of heavy meals on urease activity in soils. Biology and Fertility of Soils, 2, 213-218.

Doelman, P. and Haanstra, L. (1989). Short- and long-term effects of heavy metals on phosphatase activity in soils: an ecological dose-response model approach. Biology and Fertility of Soils, 8, 235-241.

Elmosly, W. A. and Abdel-Sabour, M. F. (1997). Transfer characteristics and uptake of nickel by red clover grown on nickel amended alluvial soils of an arid zone. Agriculture, Ecosystems and Environment, 65, 49-57.

El-Sharouny, H. M. M., Bagy, M. M. and El-Shanawany, A. A. (1988). Toxicity of heavy metals to Egyptian soil fungi. International Biodeterioration, 24, 49-64.

Frankenberger Jr, W. T. and Tabatabai, M. A. (1981). Amidase activity in soils: IV. Effects of trace elements and pesticides. Soil Science Society of America Journal, 45, 1120-1124.

Frankenberger Jr, W. T. and Tabatabai, M. A. (1991a). Factors affecting L-asparaginase activity in soils. Biology and Fertility of Soils, 11, 1-5.

Frankenberger Jr, W. T. and Tabatabai, M. A. (1991b). Factors affecting L-Glutaminase activity in soils. Soil Biology and Biochemistry, 23(9), 875-879.

Frantz, J. (2005). Greenhouse Nutrition. Michigan State University Extension Bulletin. http://www.ars.usda.gov/research/publications/publications.htm?seq_no_115=188004.

Frink, C. (1996). A perspective on metals in soils. Journal of Soil Contamination, 5(4), 329-359.

Frossard, R., Stadelmann, F. X. and Niederhauser, J. (1989). Effects of different heavy meals on fructan, sugar and starch content of ryegrass. Journal of Plant Physiology, 134, 180-185.

Frostegard, A., Tunlid, A. and Baath, E. (1993). Phospholipid fatty acid composition, biomass, and activity of microbial communities from two soil types experimentally exposed to different heavy metals. Applied and Environmental Microbiology, 59(11), 3605-3617.

Fu, M. H. and Tabatabai, M. A. (1989). Nitrate reductase activity in soils: effects of trace elements. Soil Biology and Biochemistry, 21(7), 943-946.

Giashuddin, M. and Cornfield, A. H. (1978). Incubation study on effects of adding varying levels of nickel (as sulphate) on nitrogen and carbon mineralisation in soil. Environmental Pollution, 15, 231-234.

Giashuddin, M. and Cornfield, A. H. (1979). Effects of adding nickel (as oxide) to soil on nitroden and carbon mineralisation at different pH values. environmental pollution, 19, 67-70.

Gorlach, E. and Gambus, F. (1992). A comparison of sensitivity to the toxic action of heavy metals in various plant species. Polish Journal of Soil Science, 25(2), 207-213.

Gupta, S. K., Hani, H., Santschi, E. and Stadelmann, F. X. (1987). The effect of graded doses of nickel on the yield, the nickel content of lettuce and the soil respiration. Toxicological and Environmental Chemistry, 14, 1-9.

Haanstra, L. and DoelMan, P. (1984). Glutamic acid decomposition as sensitive measure of heavy metal pollution in soil. Soil Biology and Biochemistry, 16(6), 595-600.

Haanstra, L. and Doelman, P. (1991). An ecological dose-response model approach to short- and long-term effects of heavy metals on arylsulphatase activity in soil. Biology and Fertility of Soils, 11, 18-23.

Halstead, R. L., Finn, B. J. and MacLean, A. J. (1969). Extractability of nickel added to soils and its concentration in plants. Canadian Journal of Soil Science, 49, 335-342.

Hartenstein, R., Neuhauser, E. F. and Collier, J. (1980). Accumulation of heavy-metals in the earthworm Eisenia foetida. Journal of Environmental Quality, 9(1), 23-26.

Hartenstein, R., Neuhauser, E. F. and Narahara, A. (1981). Effects of heavy metal and other elemental additives to activated sludge on growth of Eisenia fetida. Journal of Environmental Quality, 10(3), 372-376.

Hattori, H. (1992). Influence of heavy metals on soil microbial activities. Soil Science and Plant Nutrition, 38(1), 93-100.

Heale, E. L. and Ormrod, D. P. (1983). Effects of nickel and copper on seed germination and growth and develoment of seedlings of Acer ginnala, betula papyrifera, picea abies and pinus banksiana. Reclamation and Revegetation Research, 2, 41-54.

Holmgren, G. G. S., Meyer, M. W., Chaney, R. L. and Daniels, R. B. (1993). Cadmium, lead, zinc, copper, and nickel in agricultural soils of the United States of America. Journal of Environmental Quality, 22, 335-348.

Hunter, J. G. and Vergnano, O. (1953). Trace-element toxicties in oat plants. Applied Biology, 40, 761-777.

ISO, 2004. Working draft, Water Quality- Guidance document on the statistical analysis of ecotoxicity data, March 2004. ISO/CD20281

Juma, N. G. and Tabatabai, M. A. (1977). Effects of trace elements on phosphatase activity in soils. Soil Science Society of America Journal, 41, 343-346.

Khalid, B. Y. and Tinsley, J. (1980). Some effects of nickel toxicity on rye grass. Plant and Soil, 55, 139-144.

Korthals, G. W., Van De Ende, A., Van Megen, H., Lexmond, T. M., Kammenga, J. E. and Bongers, T. (1996). Short-term effects of cadmium, copper, nickel and zinc on soil nematodes from different feeding and life-history strategy groups. Applied Soil Ecology, 4, 107-117.

Krogh L., Breuning-Madsen H. and M.H. Greve (2000). Cation-exchange capacity pedotransfer functions in Danish soils. Acta Agric. Scand., Sect. B, Soil & Plant Sci.,50:1-12.

Kukkola, E., Rautio, P. and Huttunen, S. (2000). Stress indications in copper- and nickel-exposed Scots pine seedlings. Environmental and Experimental Biology, 43, 197-210.

Leon et al. 2005. Effects of Three Nickel Salts on germinating Seeds of Grevillea exul var. rubiginosa, an Endemic Serpentine Proteaceae. Annals of Botany. 95: 609-618.

Liang, C. N. and Tabatabai, M. A. (1977). Effects of trace elements on nitrogen mineralisation in soils. Environmental Pollution, 12(2), 141-147.

Liang, C. N. and Tabatabai, M. A. (1978). Effects of trace elements on nitritication in soils. Journal of Environmental Quality, 7(2), 291-293.

Liang, J. and Schoenau, J. J. (1995). Development of resin membranes as a sensitive indicator of heavy metal toxicity in the soil environment. International Journal of Environmental Analytical Chemistry, 59, 265-275.

Lighthart, B., Baham, J. and Volk, V. V. (1983). Microbial respiration and chemical speciation in metal amended soils. Journal of Environemtal Quality, 12(4), 543-548.

Lock, K. and Janssen, C. R. (2002). Ecotoxicity of nickel to Eisenia fetida, Enchytraeus albidus and Folsomia candida. Chemosphere, 46, 197-200.

Ma, W. (1982). The influence of soil properties and worm-related factors on the concentration of heavy metals in earth worms. Pedobiologia, 24, 109-119.

Ma, Y., E. Lombi, A. Nolan, and M.J. McLaughlin. 2005. Short-term natural attenuation of copper in soils: Effects of time, temperature and soil characteristics. Environ. Toxicol. Chem. (in press).

Maclean, A. and Dekker, A. (1978). Availability of zinc, copper and nickel to plants grown in sewage-treated soils. Canadian Journal of Soil Science, 58, 381-389.

Malecki, M. R., Neuhauser, E. F. and Loehr, R. C. (1982). The effect of metals on the growth and reproduction of Eisenia foetida (Oligochaeta, Lumbriciadae). Pedobiologia, 24, 129-137.

McLaughlin, M. J. and Smolders, E. (2001). Background zinc concentrations in soil affect the zinc sensitivity of soil microbial processes - a rationale for a metalloregion approach to risk assessments. Environmental Toxicology and Chemistry, 20(11), 2639-2643.

McLaughlin, M.J., Collins, R.C., and Merrington, G. (2003). Review: Behaviour of Nickel in Soil Systems. Final Report to Nickel Producers Environmental Research Association. 93pp. CSIRO Land and Water, Adelaide, Australia.

Metwally, A. I. and Rabie, M. H. (1989). Effect of Ni addition on plant growth and nutrient uptake in two soils. Egyptian Journal of Soil Science, 29(3), 261-274.

Molas and Baran. 2004. Relationship between the Chemical Form of Nickel applied to the Soil and its Uptake and Toxicity to Barley Plants (Hordeum vulgare L.). Geoderma. 122: 247-255.

Murch et al. 2003. Nickel Contamination affects Growth and Secondary Metabolite Composition of St. John's Wort (Hypericum perforatum L.). 49: 251-257.

Neuhauser, E. F., Loehr, R. C., Milligan, D. L. and Malecki, M. R. (1985). Toxicity of metals to the earthworm Eisenia Fetida. Biology and Fertility of Soils, 1, 149-152.

Neuhauser, E. F., Malecki, M. R. and Loehr, R. C. (1984). Growth and reproduction ot the earthworm Elisnenia fetida after exposure to sublethal concentrations of metals. Pedobiologia, 27, 89-97.

Nieminen, T. M. (1998). The effect of soil copper and nickel on survival and growth of scots pine saplings. Chemosphere, 36(4-5), 745-750.

Nieminen. 2004. Effects of Soil Copper and Nickel on Survival and Growth of Scots Pine. Journal of Environmental Monitoring. 6: 888-896.

Noble, A. D. and Hughes, J. C. (1991). Sequential fractionation of chromium and nickel from some serpentinite-derived soils from the Eastern Transvaal. Communications in Soil Science and Plant Analysis, 22(19&20), 1963-1973.

Palacios, G., Carbonell-Barrachina, A., Gomez, I. and Mataix, J. (1999). The influence of organic amendment and nickel pollution on tomato fruit yield and quality. Journal of Environmental Science and Health, B34(1), 133-150.

Pandey and Sharma. 2002. Effect of Heavy Metals Co2+, Ni2+ and Cd2+ on Growth and Metabolism of Cabbage. Plant Sci. 163: 753-758.

Papazaglou et al. 2005: Photosynthesis and Growth Responses of Giant Reed (Arundo donax L.) to the Heavy Metals Cd and Ni. Environment International 31: 241-249

Parida et al. 2003. Influence of Nickel-Contaminated Soils on Fenugreek (Trigonella corniculata L.) Growth and Mineral Composition. Scientia Horticulturae. 98: 113-119.

Patterson, W. and Olson, J. (1983). Effects of heavy metals on radicle growth of selected woody species germinated on filter paper, mineral and organic soil substrates. Canadian Journal of Forestry Research, 13, 233- 238.

Peredney, C. L. and Williams, P. L. (2000). Utility of Caenorhabditis elegans for assessing heavy metal contamination in artificial soil. Archives of Environmental Contamination and Toxicology, 39(1), 113-118.

Porch, J. R. and Krueger, H. O. (1999). Nickel sulfate hexahydrate: a toxicity test to determine the effects of the test substance on seedling emergence and growth of terrestrial plants: Wildlife International Ltd.

Poulik, Z. (1997). The danger of cumulation of nickel in cereals on contaminated soil. Agriculture, Ecosystems and Environment, 63, 25-29.

Poulik, Z. (1999). Influence of nickel contaminated soils on lettuce and tomatoes. Scientia Horticulturae, 81, 243-250.

Prokipcak, B. and Ormrod, D. (1986). Visible injury and growth responses of tomato and soybean to combinations of nickel, copper and ozone. Water, Air, and Soil Pollution, 27, 329-340.

Rehab, F. I. and Wallace, A. (1978). Excess trace metal effects on cotton: 6. Nickel and cadmium in Yolo loam soil. Communications in Soil Science and Plant Analysis, 9(8), 779-784.

Robinson, B. H., Brooks, R. R., Kirkman, J. H., Gregg, P. E. H. and H.V., A. (1997). Edaphic influences on a New Zealand ultramafic ("serpentine") flora: a statistical approach. Plant and Soil, 188, 11-20.

Roth, J. A., Wallihan, E. F. and Sharpless, R. G. (1971). Uptake by oats and soybeans of copper and nickel added to a peat soil. Soil Science, 112(5), 338-342.

Rothamsted Reseach, 2005. NiPERA research project on the 'development of a predictive model of bioavailbility and toxicity of Nickel in soils:Plant toxicity'.

Rout, G. R., Samantaray, S. and Das, P. (2000). Effects of chromium and nickel on germination and growth in tolerant and non-tolerant populations of Echinochloa colona (L.) Link. Chemoshpere, 40, 855-859.

Sadiq, M. (1985). Uptake of cadmium, lead and nickel by corn grown in contaminated soils. Water Air and Soil Pollution, 26(2), 185-190.

Sajwan, K. S., Ornes, W. H., Youngblood, T. V. and Alva, A. K. (1996). Uptake of soil applied cadmium, nickel and selenium by bush beans. Water, Air, and Soil Pollution, 91, 209-217.

Sauerbeck, D. R. and Hein, A. (1991). The nickel uptake from different soils and its prediction by chemical extractions. Water, Air, and Soil Pollution., 57-58, 861-871.

Saviozzi, A., Levi-Minzi, R., Cardelli, R. and Riffaldi, R. (1997). The influence of heavy metals on carbon dioxide evolution from a typic xerochrept soil. Water, Air, and Soil Pollution, 93, 409-417.

Saxe, J. K., Impellitteri, C. A., Peijnenburg, W. J. G. M. and Allen, H. E. (2001). Novel model describing trace metal concentrations in the earthworm, *Eisenia andrei*. Environmental Science & Technology, 35, 4522-4529.

Scheidegger, A.M., G.M. Lamble and D.L. Sparks. 1997. Spectroscopic evidence for the formation of mixed-cation hydroxide phases upon metal sorption on clays and aluminum oxides. J. Colloid Interf. Sci. 186:118-128.

Scott-Fordsmand, J. J., Krogh, P. H. and Hopkin, S. P. (1999). Toxicity of nickel to a soil-dwelling springtail, Folsomia fimetaria (Collembola: Isotomidae). Ecotoxicology and Environmental Safety, 43, 57-61.

Scott-Fordsmand, J. J., Weeks, J. M. and Hopkin, S. P. (1998). Toxicity of nickel to the earthworm and the applicability of the neutral red retention assay. Ecotoxicology, 7, 291-295.

Scott-Fordsmand et al. 2000.JJ, Weeks JM, Hopkins SP (2000) Importance of contamination history for understanding toxicity of copper to earthworms Eisenia fetida (oligochaeta: annelida), using neutral-red retention assay. Environmental Toxicology and Chemistry **19**, 1774-1780.

Shallari, S., Schwartz, C., Hasko, A. and Morel, J. L. (1998). Heavy metals in soils and plants of serpentine and industrial sites of Albania. The Science of the Total Environment, 209, 133-142.

Simon, T. (1999). The effect of increasing rates of nickel and arsenic on the growth of radish and soil microflora. Rostylinna Vyroba, 45(9), 421-430.

Simon, T., Eberhard, A. and Rohr, R. (2000). Effect of Ni and As on radish tuber cultivated on artificially polluted soils. European Journal of Soil Biology, 36(2), 73-80.

Simon, T., Mikanova, O. and Kubat, J. (1998). The effect of addition of inorganic Ni and As compounds on the growth of radish and activities of soil mircoorganisms. Rostlinna Vyroba, 44(4), 187-192.

Singh, B. and Jeng, A. S. (1993). Uptake of zinc, cadmium, mercury, lead, chromium and nickel by ryegrass grown in a sandy soil. Norwegian Journal of Agricultural Sciences, 7, 147-157.

Singh et al. 2004. Response of Garden Pea to Nickel Toxicity. Journal of Plant Nutrition. 27: 1543-1560.

Smolders, E. (2000). The effect of NiSO4.6H20, elemental Ni and green NiO on nitrogen transformation in soil. Leuven, Belgium: KUL.

Smolders, E., Buekers, J., Oliver, I. and McLaughlin, M.J. (2004). Soil properties affecting microbial toxicity of zinc in laboratory-spiked and field-contaminated soils. Environmental Toxicity and Chemistry, 23, 2633-2640

Sorteberg, A. (1978). Effects of some heavy metals on oats in pot experiments with three different soil types. Journal of the Scientific Agricultural Society of Finland, 50, 317-334.

Spalding, B. P. (1979). Effects of divalent metal chlorides on respiration and extractable enzymatic activites of Douglas-Fir needle litter. Journal of Environmental Quality, 8(1), 105-109.

Speir, T. W., H. A. Kettles, H. J. Percival, and A. Parshotam. 1999. Is soil acidification the cause of biochemical responses when soils are amended with heavy metal salts? Soil Biology & Biochemistry 31:1953-1961.

Stevens, D.P., M.J. McLaughlin, T. Heinrich. 2003. Determining toxicity of lead and zinc runoff in soils: salinity effects on metal partitioning and on phytotoxicity. Environmental Toxicology and Chemistry 22: 3017-3024.

Steyn, C. E., Watt, H. v. H. v. d. and Claassens, A. S. (1996). On the permissible nickel concentration for South African soils. South African Journal of Science, 92, 359-363.

Stott, D. E., Dick, W. A. and Tabatabai, M. A. (1985). Inhibition of pyrophosphatase activity in soils by trace elements. Soil Science, 139(2), 112-117.

Symeonidis, L., McNeilly, T. and Bradshaw, A. D. (1985). Differential tolerance of three cultivars of agrostis capillaris L. to cadmium, copper, lead, nickel and zinc. New Phytologist, 101, 309-315.

Tabatabai, M. A. (1977). Effects of trace elements on urease activity in soils. Soil Biology and Biochemistry, 9, 9-13.

Taylor, R. W. and Allinson, D. W. (1981). Influence of lead, cadmium, and nickel on the growth of Medicago sativa (L.). Plant and Soil, 60, 223-236.

TGD (1996). Technical Guidance Document in Support of Commission Directive 93/67/EEC on RIsk Assessment for New Notified Substances and Commission Regulation (EC) No 1488/94 on Risk Assessment for Existing Substances. Office for Official Publications of the European Commission, Luxembourg.

University of Ghent/Euras 2005. NiPERA research project on the 'Bioavailability and ageing of Nickel in soils: invertebrate toxicity testing'.

University of Leuven 2005. NiPERA research project on the 'development of a predictive model of bioavailbility and toxicity of Nickel in soils: microbial toxicity'.

US EPA. (2002). Attachment 3-2 Ecological Soil Screening Level Guidance - Interim Final. Plant and Soil Invertebrate Standard Operating Procedure # 3: Literature Evaluation, Data Extraction, and Eco-SSL Calculation (Attachment 3-2): USA EPA.

van Vlaardingen, P. and Traas, T. P. (2001). ETX-temporary (Version 1.4 (02)): RIVM.

Vergnano, O. and Hunter, J. G. (1952). Nickel and cobalt toxicities in oat plants. Annals of Botany, 17(66), 317-329.

Vesper, S. J. and Weidensaul, T. C. (1978). Effects of cadmium, nickel, copper, and zinc on nitrogen fixation by soybeans. Water, Air, and Soil Pollution, 9, 413-422.

Vijver, M., Jager, T., Posthuma, L. and Peijnenburg, W. (2001). Impact of metal pools and soil properties on metal accumulation in Folsomia candida (Collembola). Environmental Toxicology And Chemistry, 20, 712-720.

Vijver, M. G., Vink, J. P. M., Miermans, C. J. H., van Gestel, C. A. M. (2003) Oral sealing using glue: a new method to distinguish between intestinal and dermal uptake of metals in earthworms. Soil Biology & Biochemistry, 35, 125-132.

Wallace, A. and Berry, W. (1989). Dose-response curves for zinc, cadmium, and nickel in combinations of one, two, or three. Soil science, 147(6), 407- 410.

Wallace, A., Romney, E. M., Cha, J. W. and Soufi, S. M. (1977). Nickel phtotoxicity in relationship to soil pH manipulation and chelating agents. Communications in Soil Science and Plant Analysis, 8(9), 757-764.

Wang et al. 2003. Alleviating Effects of Calcium on Nickel Toxicity Towards Rice Seedlings. J. Agro-Environ Sci 22: 357-359

Webber, J. (1972). Effects of toxic metals in sewage on crops. Water Pollution Control(404-413).

Welp, G. (1999). Inhibitory effects of the total and water-soluble concentrations of nine different metals on the dehydrogenase activity of a loess soil. Biology and Fertility of Soils, 30, 132-139.

Wilke, B. (1988). Long-term effects of inorganic pollutants on microbial activity of a sandy cambisol. Z. Pflanzenernahr. Bodenk, 151, 131-136.

Wilke, B. M. (1991). Effects of single and successive addtiions of cadmium, nickel and zinc on carbon dioxide evolution and dehydrogenase activity in a sandy luvisol. Biology and Fertility of Soils, 11, 34-37.

Willaert, G. and Verloo, M. (1988). Biological effects of nickel species and their determination in plant and soil. Plant and Soil, 107, 285- 292.

6.2.4 References, Section 3.2, Secondary Poisoning

Beolchini, F. and A. Loy. 2004. Diet of syntopic moles *Talpa romana* and *Talpa europaea* in central Italy. Mamm. Biol. 69(2):140-144.

Beyer, W.N., R.L. Chaney, and B.M. Mulhern. 1982. Heavy metal concentrations in earthworms from soil amended with sewage sludge. J. Environ. Qual. 11(3):381-385.

Blaylock, B.G. and M.L. Frank. 1979. A comparison of the toxicity of nickel to the developing eggs and larvae of carp (*Cyprinus carpio*). Bull. Environ. Contam. Toxicol. 21:604-611.

Born, E.W., S. Rysgaard, G. Ehlme, M. Sejr, M. Acquarone, and N. Levermann. 2003. Underwater observations of foraging free-living Atlantic walruses (*Odobenus rosmarus rosmarus*) and estimates of their food consumption. Polar Biol. 26:348-357.

Boyden, C.R. 1975. Distribution of some trace metals in Poole Harbour, Dorset. Mar. Pollut. Bull. 6:180-187.

Brix, K.V. and D.K. DeForest. 2000. Critical review of the use of bioconcentration factors for hazard classification of metals and metal compounds. Prepared by Parametrix, Inc. for ILZRO, ICA, and NiPERA.

Bryan, G.W. and L.G. Hummerstone. 1977. Indicators of heavy-metal contamination in the Looe Estuary (Cornwall) with particular regard to silver and lead. J. Mar. Biol. Assoc. U.K. 57:75-92.

Cain, B.W. and E.A. Pafford. 1981. Effects of dietary nickel on survival and growth of mallard ducklings. Arch. Environ. Contam. Toxicol. 10:737-745.

Campbell, L.M., R.J. Norstrom, K.A. Hobson, D.C.G. Muir, S. Backus, and A.T. Fisk. 2005. Mercury and other trace elements in a pelagic Arctic marine food web (Northwater Plynya, Baffin Bay). Sci. Total Environ. 351-352:247-263.

Churchfield, S. 1990. The natural history of shrews. A&C Black, London, UK. 178 pp.

Cid, B.P., C. Boia, L. Pombo, and E. Rebelo. 2001. Determination of trace metals in fish species of the Ria de Aveiro (Portugal) by electrothermal atomic absorption spectrometry. Food Chem. 75: 93-100.

Jacques Whitford Limited. 2005a. Exposure Assessment. Chapter 6. Port Colborne CBRA ERA – Natural Environment. Draft report prepared for INCO Ltd. 52 pp.

Jacques Whitford Limited. 2005b. Oral bioavailability and bioaccessibility of CoCs in Port Colborne soils. Appendix 8 of Port Colborne CBRA – Human Health Risk Assessment. Draft report prepared for INCO Ltd. 261 pp.

Crocker, D., A. Hart, J. Gurney, and C. McCoy. 2002. Methods for estimating daily food intake of wild birds and mammals. Project PN0908. Central Science Laboratory, England. 22 pp.

Croteau, M.-L., S.N. Luoma, and A.R. Stewart. 2005. Trophic transfer of metals along freshwater food webs: Evidence of cadmium biomagnification in nature. Limnol. Oceanogr. 50(5):1511-1519.

Dean, T.A., J.L. Bodkin, A.K. Fukuyama, S.C. Jewett, D.H. Monson, C.E. O'Clair, and G.R. Van Blaricom. 2002. Food limitation and the recovery of sea otters following the 'Exxon Valdez' oil spill. Mar. Ecol. Prog. Ser. 241:255-270.

DEPA (Danish Environmental Protection Agency). 2004. Aquatic effect assessment for nickel. Background report on the nickel ion. Draft. March 2004.

Dunning, J.B., Jr. 1993. CRC Handbook of Avian Body Masses. CRC Press, Inc., Boca Raton, Florida. 371 p.

Eastin, W.C. and T.J. O'Shea. 1981. Effects of dietary nickel on mallards. J. Toxicol. Environ. Health 7: 883-892.

Estes, J.A., R.J. Jameson, and E.B. Rhode. 1982. Activity and prey election in the sea otter: influence of population status on community structure. Am. Nat. 120:242-258.

Fisher, N.S. and J.R. Reinfelder. 1995. The trophic transfer of metals in marine systems. Pages 363-406 in A. Tessier and D.R. Turner, Eds. Metal speciation and bioavailability in aquatic systems. John Wiley and Sons, Ltd., Chichester, U.K. 679 pp.

Gish, C.D. and R.E. Christensen. 1973. Cadmium, nickel, lead, and zinc in earthworms from roadside soil. Environ. Sci. Technol. 7(11):1060-1062.

Gobas, F.A.P.C. and H.A. Morrison. 2000. Bioconcentration and biomagnification in the aquatic environment. Pages 189-231 in R.S. Boethling and D Mackay, Eds. Handbook of property estimation methods for chemicals: Environmental and health sciences. Lewis Publishers, Boca Raton, Florida. 481 pp.

Gorman, M. and R.D. Stone. 1990. The natural history of moles. Comstock Publishing Associates, Ithaca, NY. 138 pp.

Goss-Custard, J.D. 1977. The ecology of the Wash. III. Density-related behavior and the possible effects of a loss of feeding grounds on wading birds (Charadrii). J. Appl. Ecol. 14:721-739.

Hammond, P.S., A.J. Hall, and J.H. Prime. 1994a. The diet of grey seals around Orkney and other island and mainland sites in north-eastern Scotland. J. App. Ecol. 31:340-350.

Hammond, P.S., A.J. Hall, and J.H. Prime. 1994b. The diet of grey seals in the Inner and Outer Hebrides. J. App. Ecol. 31:737-746.

Hjelset, A.M., M. Andersen, I. Gjertz, C. Lydersen, and B. Gulliksen. 1999. Feeding habits of bearded seals (*Erignathus barbatus*) from the Svalbard area, Norway. Polar Biol. 21:186-193.

Hook, S.E. and N.S. Fisher. 2001a. Sublethal effects of silver in zooplankton: Importance of exposure pathways and implications for toxicity testing. Environ. Toxicol. Chem. 20(3):568-574.

Hook, S.E. and N.S. Fisher. 2001b. Reproductive toxicity of metals in calanoid copepods. Mar. Biol. 138:1131–1140.

Innes, S., D.M. Lavigne, W.M. Earle, and K.M. Kovacs. 1987. Feeding rates of seals and whales. J. Anim. Ecol. 56(1):115-130.

Janssen, R.P.T., L. Posthuma, R. Baerselman, H.A. Den Hollander, R.P.M. Van Veen, and W.J.G.M. Peijnenburg. 1997a. Equilibrium partitioning of heavy metals in Dutch field soils. II. Prediction of metal accumulation in earthworms. Environ. Toxicol. Chem. 16(12):2479-2488.

Janssen, R.P.T., W.J.G.M. Peijnenburg, L. Posthuma, and M.A.G.T. Van Den Hoop. 1997b. Equilibrium partitioning of heavy metals in Dutch field soils. I. Relationship between metal partition coefficients and soil characteristics. Environ. Toxicol. Chem. 16(12):2470-2478.

Jarvinen, A.W. and G.T. Ankley. 1999. Linkage of effects to tissue residues: Development of a comprehensive database for aquatic organisms exposed to inorganic and organic chemicals. SETAC Press, Pensacola, Florida. 364 pp.

Jedrzejewska, B., V.E. Sidorovich, M.M. Pikulik, and W. Jedrzejewski. 2001. Feeding habits of the otter and the American mink in Bialowwieza primeval forest (Poland) compared to other Eurasian populations. Ecography 24:165-180.

Kvitek, R. and C. Bretz. 2004. Harmful algal bloom toxins protect bivalve populations from sea otter predation. Mar. Ecol. Prog. Ser. 271:233-243.

Lapointe, D. and P. Couture. 2006. Importance of the route of exposure in accumulation and subcellular partioning of nickel in fathead minnows (*Pimephales promelas*). Presentation P484 at the 27th Annual Meeting of the Society for Environmental Toxicology and Chemistry, Montreal, Quebec. November, 2006.

Ling, J.R. and R.M. Leach, Jr. 1979. Studies on nickel metabolism: interaction with other mineral elements. Poultry Sci. 58:591-596.

Lind, D., K. Alto, and S. Chatterton. 1978. Regional copper-nickel study: aquatic toxicology study. Minnesota Environmental Quality Board. 56 pp.

Ma, W.-C. 1982. The influence of soil properties and worm-related factors on the concentration of heavy metals in earthworms. Pedobiologia 24:109-119.

Marques, C.C., A. Sanchez-Chardi, S.I. Gabriel, J. Nadal, A.M. Viegas-Crispo, and M.d-L. Mathias. 2007. How does the greater white-toothed shrew, *Crocidura russula*, responds to long-term heavy metal contamination? A case study. Sci. Total Environ. 376:128-133.

McGeer, J.C., K.V. Brix, J.M. Skeaff, D.K. DeForest, S.I. Brigham, W.J. Adams, and A.S. Green. 2003. The inverse relationship between bioconcentration factor and exposure concentration for metals: implications for hazard assessment of metals in the aquatic environment. Environ. Toxicol. Chem. 22(5):1017-1037.

Meyer J.S., W.J. Adams, K.V. Brix, S.N. Luoma, D.R. Mount, W.A. Stubblefield, and C.M. Wood. 2005. Toxicity of dietborne metals to aquatic organisms. Society of Environmental Toxicology and Chemistry, Pensacola, FL. 329 pp.

Muir, D., X. Wang, D. Bright, L. Lockhart, and G. Kock. 2005. Spatial and temporal trends of mercury and other metals in landlocked char from lakes in the Canadian Arctic archipelago. Sci. Total Environ. 351-352:464-478.

Muyssen, B.T.A., K.V. Brix, D.K. DeForest, and C.R. Janssen. 2004. Nickel essentiality and homeostasis in aquatic organisms. Environ. Rev. 12:113-131.

Nagy, K.A. 1987. Field metabolic rate and food requirement scaling in mammals and birds. Ecol. Monogr. 57:111-128.

Neuhauser, E.F., Z.V. Cukic, M.R. Malecki, R.C. Loehr, and P.R. Durkin. 1995. Bioconcentration and biokinetics of heavy metals in the earthworm. Environ. Pollut. 89(3):293-301.

Nott, J.A. and A. Nicolaidou. 1994. Variable transfer of detoxified metals from snails to hermit crabs in marine food chains. Mar. Biol. 120:369-377.

Outridge, P.M. and A.M. Scheuhammer. 1993. Bioaccumulation and toxicology of nickel: implications for wild mammals and birds. Environ. Rev. 172-197.

Oscar, T.P., D.M. Mitchell, H.M. Engster, B.R. Malone, and W.M. Watson. 1995. Growth performance, carcass composition, and pigmentation of broilers fed supplemental nickel. Poultry Sci. 74:976-982.

Pernetta, J.C. 1976. Diets of the shrews *Sorex araneus* L. and *Sorex minutus* L. in Wytham grassland. J. Animal Ecol. 45(3):899-912.

Peterson, L.R., V. Trivett, A.J.M. Baker, C. Aguiar, and A.J. Pollard. 2003. Spread of metals through an invertebrate food chain as influenced by a plant that hyperaccumulates nickel. Chemoecol. 13:103-108.

Preston, S.J., A.A. Portig, W.I. Montgomery, R.A. McDonald, and J.S. Fairley. 2006. Status and diet of the otter *Lutra lutra* in northern Ireland. Biol. Environ. Proc. Roy. Irish Acad. 106B(1):1-7.

Reeves, R.R., B.S. Stewart, P.J. Clapham, and J.A. Powell. 2002. Guide to marine mammals of the world. New York, Alfred A. Knopf, Inc.

Regan, H.M., B.E. Sample, and S. Ferson. 2002. Comparison of deterministic and probabilistic calculation of ecological soil screening levels. Environ. Toxicol. Chem. 21(4):882-890.

Reinfelder, J.R., N.S. Fisher, S.N. Luoma, J.W. Nichols, and W.X. Wang. 1998. Trace element trophic transfer in aquatic organisms: A critique of the kinetic model approach. Sci. Total Environ. 219:117-135.

Saavedra, Y., A. Gonzalez, P. Fernandez, and J. Blanco. 2004. Interspecific variation of metal concentrations in three bivalve mollusks from Galicia. Arch. Environ. Contam. Toxicol. 47:341-351.

Scott-Fordsmand, J.J. 1997. Toxicity of nickel to soil organisms in Denmark. Rev. Environ. Contam. Toxicol. 148:1-34.

Sofyan, A., G. Rosita, D.J. Price, and W.J. Birge. 2007. Cadmium uptake by Ceriodaphnia dubia from different exposures: Relevance to body burdens and toxicity. Environ. Toxicol. Chem. 26(3):470-477.

Stephan, C.E., D.I. Mount, D.J. Hansen, J.H. Gentile, G.A. Chapman, and W.A. Brungs. 1985. Guidelines for deriving numerical national water quality criteria for the protection of aquatic organisms and their uses. U.S. EPA, Washington, D.C. NTIS No. PB85-227049. 98 pages.

Suedel, B.C., J.A. Boraczek, R.K. Peddicord, P.A. Clifford, and T.M. Dillon. 1994. Trophic transfer and biomagnification potential of contaminants in aquatic ecosystems. Rev. Environ. Contam. Toxicol. 136:22-89.

Sunderman, F.W., S.M. Hopfer, K.R. Sweeney, A.H. Marcus, B.M. Most, and J. Creason. 1989. Nickel absorption and kinetics in human volunteers. Proc. Soc. Exp. Biol. Med. 191:5-11.

Szefer, P., K. Frelek, K. Szefer, C.B. Lee, B.S. Kim, J. Warzocha, I. Zdrojewska, and T. Ciesielski. 2002. Distribution and relationships of trace metals in soft tissue, byssus and shells of *Mytilus edulis trossulus* from the southern Baltic. Environ. Poll. 120(2):423-444.

Taastrom, H.M. and L. Jacobsen. 1999. The diet of otters (*Lutra lutra* L.) in Danish freshwater habitats: comparisons of prey fish populations. J. Zool. Lond. 248:1-13.

TGD. 2003. Technical guidance document on risk assessment. Part II. European Commission, Joint Research Centre. EUR 204 18 EN/2.

Thompson, P.M., B.J. McConnell, D.J. Tollit, A. Mackay, C. Hunter, and P.A. Racey. 1996. Comparative distribution, movements and diet of harbour and grey seals from the Moray Firth, N.E. Scotland. J. App. Ecol. 33:1572-1584.

Tjälve, H., J. Gottofrey, and K. Borg. 1988. Bioaccumulation, distribution and retention of 63Ni2+ in the brown trout (*Salmo trutta*). Wat. Res. 22(9):1129-1136.

Tollit, D.J., A.D. Black, P.M. Thompson, A. Mackay, H.M. Corpe, B.F. Wilson, S.M. Van Parijs, K. Grellier, and S. Parlane. 1998. Variation in harbour seal *Phoca vitulina* diet and dive-depths in relation to foraging habitat. J. Zool. 244:209-222.

Torres, K.C. and M.L. Johnson. 2001. Bioaccumulation of metals in plants, arthropods, and mice at a seasonal wetland. Environ. Toxicol. Chem. 20(11):2617-2626.

Türkmen, A., M. Turkmen, Y. Tepe and I. Akyurt. 2005. Heavy metals in three commercially valuable fish species from Iskenderun Bay, North East Mediterranean Sea, Turkey. Food Chem. 91:167-172.

USEPA. 1993. Wildlife exposure factors handbook. Volume 1 of 2. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. EPA/600/R-93/187a.

USEPA. 2007. Ecological soil screening levels for nickel. Interim final. OSWER Directive 9285.7-76. Office of Solid Waste and Emergency Response, USEPA, Washington, D.C.

Usero, J., J. Morillo, and I. Gracia. 2005. Heavy metal concentrations in molluscs from the Atlantic coast of southern Spain. Chemosphere 59:1175-1181.

Waegeneers, N. and E. Smolders. 2003. Secondary poisoning of nickel to marine birds. Heverlee, Belgium, Department of Land Management. 20 pp.

Weber, C.W. and B.L. Reid. 1968. Nickel toxicity in growing chicks. J. Nutr. 95:612-616.

Wilson, J.G. 1980. Heavy metals in the estuarine macrofauna of the east coast of Ireland. J. Life Sci., Royal Dublin Society 1:183-189.

Wilson, J.H., Wilson, E.J. and Ruszler, P. 2001. Dietary nickel improves male broiler (*Gallus domesticus*) bone strength. Biological Trace Element Research 83: 239-249.

Yilmaz, A.B. 2003. Levels of heavy metals (Fe, Cu, Ni, Cr, Pb, and Zn) in tissue of *Mugil cephalus* and *Trachurus mediterraneus* from Iskenderun Bay, Turkey. Environ. Res. 92:277-281.

Zhang, L. and W.-X. Wang. 2007. Size-dependence of the potential for metal biomagnifications in early life stages of marine fish. Environ. Toxicol. Chem. 26(4):787-794.

Zwarts, L., J.H. Wanink, and B.J. Ens. 1996. Predicting seasonal and annual fluctuations in the local exploitation of different prey by oystercatchers *Haematopus ostralegus*: a ten-year study in the Wadden Sea. Ardea 84: 401-440.

No references for 3.3.1 – Summary of the PNECs Dericed ???, 3.3.2 – Local Risk Characterization

6.3 REFERENCES, SECTION 3.3

Helling, C. S., Chesters, G., & Corey, R. B. 1964. Contribution of organic matter and clay to soil cation exchange capacity as a!ected by the pH of the saturating solution. Soil Science Society America, 28, 517-520.

McGrath, S.P. and Loveland, P.J., 1992. The soil geochemical atlas of England and Wales. Blackie Academic & Professional, London, 101 pp.

Parametrix. 2005. Determination of the Spatial Distribution of Soil Bioavailability Parameters in the European Union. Study commissioned by the European Copper Institute (ECI), 28 p.