Executive Summary and Conclusions

Introduction

Metal Fluxes from Society to the Environment and Between Environmental Media
Speciation, Bioavailability and Effects of Trace Metals in the Environment

General Conclusions

Purpose of this Review

Background and Justification

The Need and How to Meet It

Target Groups for the Updated Report

Implementation of the Work

Global Extraction, Production and Consumption

Copper

Nickel

Zinc

Metal Cycles in Defined Geographical Areas: Europe, the Netherlands and Stockholm

Example 1: The European Copper Cycle

Example 2: Dynamic Modelling of Metal Flows in the Netherlands; Cu and Zn

Example 3: Urban Metal Flows - Stockholm; Cr, Cu, Ni and Zn

Critical Steps in Metal Fluxes from Society to the Environment - Some Case Studies

Case Study 1: Corrosion and Runoff of Metals from Roofing Materials made of Copper, Galvanized Steel or Stainless Steel

Case Study 2: Relative Importance of the Traffic Sector for Metal Fluxes from the Urban Environment to Aquatic Ecosystems

Case Study 3: Metal Fluxes from Households to STPs, Sludge and Agricultural Soils

Case Study 4: Metal fluxes from Mine Waste to Rivers - Falun Copper Mine

Summing Up: Fluxes of Cr, Cu, Ni and Zn from Society to the Environment

Speciation, Mobility and Bioavailability of Metals in the Environment

Introduction

In Surface Waters

In Groundwaters

In Aquatic Sediments

In Soils

In Biota

A Proposal for "Natural" or "Preindustrial" Regional Background Levels of Metals in the Sediment in Waters Surrounding Stockholm

Biotic Ligand Models

Need for Improved Models to Assess Bioavailable Fraction of Metals

Development of Biotic Ligand Models

Application of BLMs

Toxic and Other Adverse Biological Effects of Trace Metals