Health risks of heavy metals from long-range transboundary air pollution

WORLD HEALTH ORGANIZATION
EUROPE

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Keywords
AIR - standards
AIR POLLUTION - analysis
AIR POLLUTANTS - adverse effects
CHEMICALS - toxicity - adverse effects
ENVIRONMENTAL MONITORING
RISK ASSESSMENT

ISBN 978 92 890 7179 6

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Printed in Germany

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Joint WHO/Convention Task Force on the Health Aspects of Air Pollution

Abstract

The heavy metals cadmium, lead and mercury are common air pollutants, being emitted mainly as a result of various industrial activities. Although the atmospheric levels are low, they contribute to the deposition and build-up in soils. Heavy metals are persistent in the environment and are subject to bioaccumulation in food-chains.

Cadmium exposures are associated with kidney and bone damage. Cadmium has also been identified as a potential human carcinogen, causing lung cancer. Lead exposures have developmental and neurobehavioural effects on fetuses, infants and children, and elevate blood pressure in adults. Mercury is also toxic in the elemental and inorganic forms, but the main concern is associated with the organic compounds, especially methylmercury, that accumulate in the food-chain, i.e. in predatory fish in lakes and seas, as these are the main routes of human exposure.

Long-range transboundary air pollution is only one source of exposure to these metals but, because of their persistence and potential for global atmospheric transfer, atmospheric emissions affect even the most remote regions. This report, based on contributions from an international group of experts, reviews the available information on the sources, chemical properties and spatial distribution of environmental pollution with cadmium, lead and mercury caused by long-range transboundary air pollution, and evaluates the potential health risks in Europe.

Contents

Abbreviations

Organizations

ATSDR	Agency for Toxic Substances and Disease Registry
CDC	Centers for Disease Control and Prevention (http://www.cdc.gov).
ECEH	WHO European Centre for Environment and Health (www.euro.who.int)
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (http://www.emep.int)
FAO	Food and Agriculture Organization of the United Nations (http://www.fao.org)
IARC	International Agency for Research on Cancer (http://www.iarc.fr)
ILO	International Labour Organization (www.ilo.org)
IPCS	International Programme on Chemical Safety, a joint programme of ILO, UNEP and WHO (http://www.who.int/ipcs/en/)
JECFA	Joint FAO/WHO Expert Committee on Food Additives
MSC-E	EMEP Meteorological Synthesizing Centre – East (http://www.msceast.org/)
MSC-HM	EMEP Meteorological Synthesizing Centre – Heavy Metal
NHANES	National Health and Nutritional Examination Surveys
TFMM	EMEP Task Force on Measurements and Modelling (http://www.nilu.no/projects/ccc/tfmm/index.html)
UNECE	United Nations Economic Commission for Europe (www.unece.org)
UNEP	United Nations Environment Programme (http://www.unep.org)
USEPA	United States Environmental Protection Agency (http://www.epa.gov)

Technical terms

ALAD	δ-aminolevulinic acid dehydratase (an indicator of lead poisoning)
B-Cd	blood cadmium
β_2-M	β_2-microglobulin (protein; an indicator of tubular damage)
BMDL	benchmark dose level
B-Pb	blood lead
bw	body weight
Cd	cadmium (metallic element; atomic number 48)
CdO, CdS, $CdCl_2$	cadmium oxide, cadmium sulfide, cadmium dichloride (inorganic cadmium compounds)
CI	confidence interval (a measure of statistical uncertainty in numerical estimates)
H-Hg	mercury level in hair
Hg	mercury (metallic element; atomic number 80)
IQ	intelligence quotient (a measure of personal