

- Improvement of models for the transport of HM in air, soil and water and their application to simulate the transport of HM in these media; modeling results have been evaluated vs. measurement data.
- Collection of information on thresholds and on exposure-response relationships for human health as well as for damages to ecosystems.
- Assessment of avoided damage from HM exposure by transferring monetary values from available contingent valuation studies.
- Estimation of the health impacts and of the exceedances of critical loads for ecosystems for two scenarios for 2010: a business as usual scenario, and a (MFTR) scenario where a number of economically feasible technical measures have been implemented.
- Estimation of overall damage costs per country and of country specific costs per t of HM released.

## Achieved results

### Emissions of HM into air, soil and water

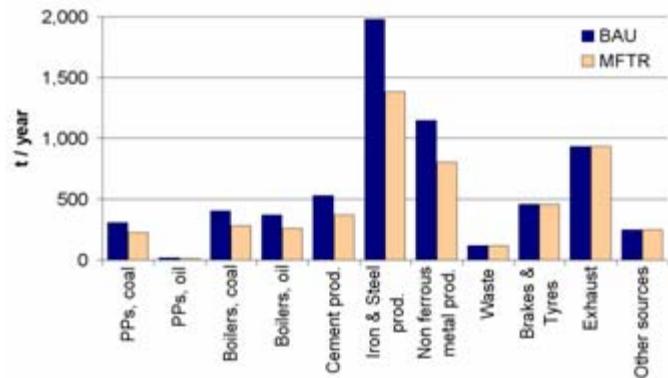


Fig1: Contribution of different anthropogenic sources to the air emissions of Pb in Europe, BAU 2010

Detailed data on the emissions of HM to air, water and soil have been generated which cover the base year 2000 as well as two scenarios for 2010.

The emission inventories to air (Fig 1 shows the data for lead) have been improved and emissions into soils due to agricultural activities (Fig 2) have been estimated, all available in a high temporal (hourly) and spatial (50x50km<sup>2</sup>) resolution.

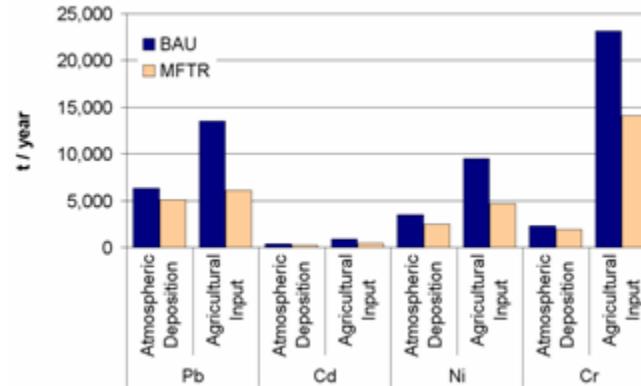


Fig2: Contribution of atmospheric deposition and agricultural input to direct emissions into soil in Europe, BAU 2010

As an example, Fig 3 shows the spatial resolution of lead emissions in Europe for the business as usual scenario 2010.

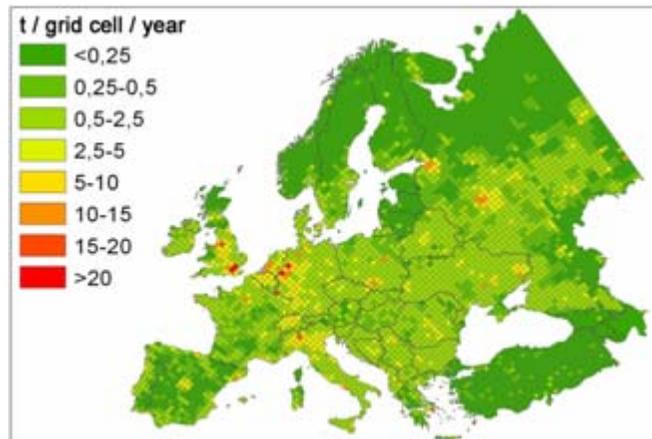


Fig3: Pb emissions in Europe, BAU 2010

Data sets with costs and potential of emission reduction measures

A detailed data base containing the main features of a large number of measures to reduce heavy metal emissions for all relevant sectors has been compiled. It contains for each measure the possible reduction of the emission factor, the possibilities and constraints of implementing it and the costs.

*Detailed concentration maps of HM concentrations in air and deposition onto water and soil*

Transport and deposition of HM in the atmosphere has been modeled using the atmospheric model of MSC-East. The pathway of HM in water and soil, crop plants and food has been estimated with the multimedia model WATSON.

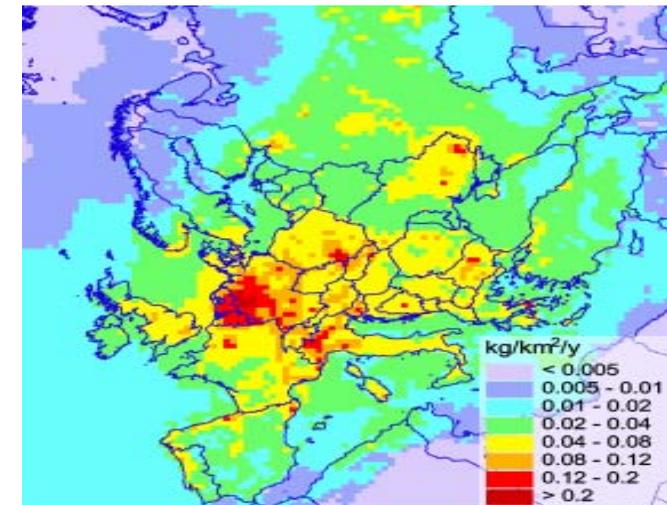


Fig4: Deposition of Cd in Europe, BAU 2010

With these models, concentrations and deposition fields as well as intake via ingestion have been generated for the different scenarios as exemplarily shown in Fig 4 for cadmium.

*A set of exposure-response-relationships to calculate impacts to human health and a procedure to estimate the exceedances of critical loads in soil*

Health endpoints covered include cancer, IQ losses, renal dysfunctions, still birth, cardiovascular mortality, anaemia, ataxia and osteoporosis.

Estimation of the damage to human health for the different emission scenarios

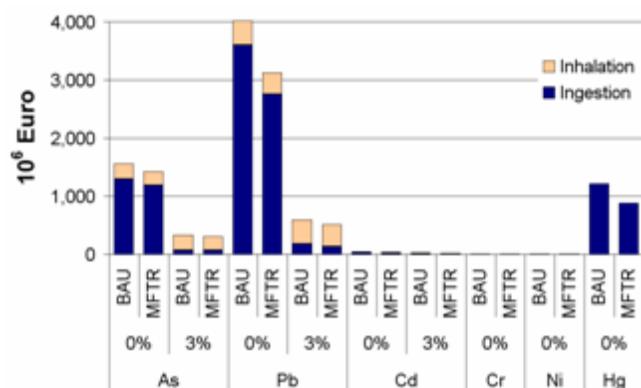


Fig5: Total external costs due to inhalation and ingestion exposure, 2010

Human health impacts and related external costs have been calculated for different emission scenarios (Fig 5), in addition marginal costs in € per ton as shown in Fig 6 have been generated.

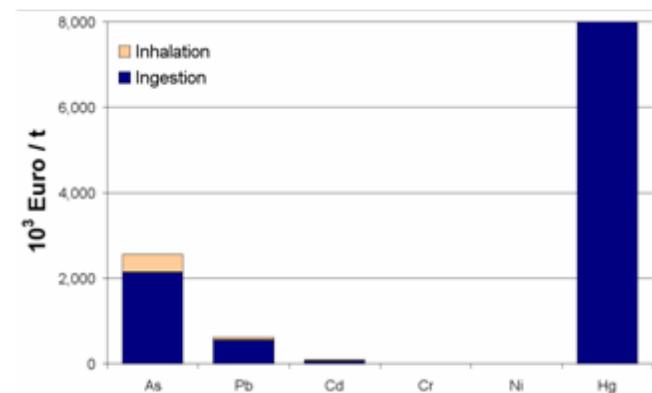


Fig6: Marginal external costs due to inhalation and ingestion exposure, 2010

Especially measures, that reduce simultaneously HM and other substances like other PM10 or SO2 have been found to be efficient. These include enhancement of dust filters, substitution of coal, further implementation of flue gas desulphurization and further reduction of lead in 'unleaded' gasoline.

## Project Title

Integrated assessment of releases of heavy metals in Europe

## Project Acronym

ESPROME

## Project Reference

502527

## Duration

39 months (2003-2007)

## EC Contribution

€ 892,078

## Priority

FP6 Scientific Support to Policies

## Website

<http://espreme.ier.uni-stuttgart.de>

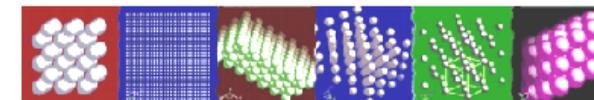
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## Partners

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- Norwegian Institute for Air Research (NILU), <http://www.nilu.no>
- Institute for Ecology of Industrial Areas (IETU), <http://www.ietu.katowice.pl>
- Meteorological Synthesizing Center-East (MSC-E), <http://www.msceast.org>
- Swedish Environmental Research Institute (IVL), <http://www.ivl.se>
- NILU Polska, <http://www.nilu.pl>
- Institute of Occupational Medicine (IOM), <http://www.iom-world.org>
- Institute for Atmospheric Pollution (CNR-IIA), <http://www.cs.ia.cnr.it>
- Czech Hydrometeorological Institute (CHMI), <http://www.chmi.cz>
- Etzel Müszaki Szolgáltató Bt. (ETZEL)



# ESPROME

 EU 6th Framework Programme

## The ESPROME Project

INTEGRATED ASSESSMENT OF  
RELEASES OF HEAVY METALS  
IN EUROPE

## Objective

*The aim of ESPROME was to develop methods and to identify strategies to support EU environmental policy-making for reducing the emissions and thus the harmful impacts of heavy metals (HM). The core aim of the research was to carry out cost-effectiveness (CEA) and cost-benefit analyses (CBA) for reducing the HM occurrence in the EU including damage assessment to the environment and human health in the long term. The priority metals mercury, cadmium, lead, nickel, arsenic and chromium have been covered.*

## The project's workplan

The following tasks have been carried out:

- Consolidation, improvement and provision of European wide emission data of the heavy metals considered.
- Systematic collection of data on possibilities to reduce emissions. Data on costs and effectiveness of abatement options have been collected as well as stock and activity data and emission factors for 2000 and 2010.