



Environmental Burden of Disease –
European countries (EBoDE) project

Quantification, comparison and ranking
of environmental stressors within
and between participating countries

Report of the first project meeting

**WHO European Centre for Environment and Health
Bonn, Germany**

12–13 February 2009

ABSTRACT

The experts participating in the Environmental Burden of Disease – European countries project agreed on the specific tasks and timetable. The steering group and specific task groups were established. The first project results should be ready for presentation at the Fifth Ministerial Conference on Environment and Health in March 2010 in Parma, Italy.

Address requests about publications of the WHO Regional Office for Europe to:

Publications
WHO Regional Office for Europe
Scherfigsvej 8
DK-2100 Copenhagen Ø, Denmark

Alternatively, complete an online request form for documentation, health information, or for permission to quote or translate, on the Regional Office web site (<http://www.euro.who.int/pubrequest>).

© **World Health Organization 2009**

All rights reserved. The Regional Office for Europe of the World Health Organization welcomes requests for permission to reproduce or translate its publications, in part or in full.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by the World Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either express or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the World Health Organization be liable for damages arising from its use. The views expressed by authors, editors, or expert groups do not necessarily represent the decisions or the stated policy of the World Health Organization.

CONTENTS

EXECUTIVE SUMMARY	3
INTRODUCTION	4
PROJECT OBJECTIVES	4
CRITERIA FOR SELECTION OF THE STRESSORS	5
SELECTED EXPOSURE FACTORS	6
HEALTH ENDPOINTS AND D-R MODELLING.....	7
S1 Benzene	7
S2 Dioxins.....	7
S3 Environmental tobacco smoke	7
S4 Formaldehyde.....	7
S5 Lead	7
S6 Environmental noise.....	8
S7 Ozone.....	8
S8 Particulate matter	8
S9 Radon	8
NATIONAL EXPOSURE DATA	8
PROJECT SCHEDULE	9
WIKI-SITE FOR DOCUMENTATION AND DATA SHARING	9
STEERING GROUP AND TASK GROUPS	9
Task group 1: National exposure data	10
Task group 2: Health endpoints and D-R relationships	10
Task group 3: DALY valuations and EBD modelling.....	10
Task group 4: Uncertainty analysis.....	10
CONCLUSIONS.....	10
REFERENCES	11

FURTHER READING	12
ANNEX 1 FINAL PROGRAMME	14
ANNEX 2 LIST OF PARTICIPANTS	15

Executive summary

1. A total of 15 participants from 5 countries, World Health Organization (WHO) headquarters and the WHO Regional Office for Europe attended the first meeting of Environmental Burden of Disease – European countries project (EBoDE) in Bonn, Germany, 12-13 February 2009.
2. Ongoing WHO and national activities regarding environmental burden of diseases were reviewed, the project objectives, methods, organization, tasks, and timetable were defined, and the priority target stressors were selected and assigned.
3. The objective of the EBoDE is to develop comparative methods for the international assessment of health impacts estimated as disability-adjusted life years (DALYs) lost from environmental stressors.
4. The methods would be based on (i) attributable fractions applied to WHO estimates for the national burden of diseases and; and (ii) disability-adjusted life year (DALY) calculated from data on incidences, durations and severity factors, depending on the availability and applicability of data.
5. The four task groups were set up, and responsibility for development and collaboration in the key areas were assigned. Task groups are: national exposure data; health endpoints and does-response (D-R) relationships; DALY valuations and EBD modelling; and uncertainty analysis.
6. New participants would be invited to join the project. Project information and progress reports would become available on a restricted-access web site.
7. First priority factors were benzene, dioxins, environmental tobacco smoke (ETS), formaldehyde, lead, environmental noise, ozone, particulate matter, and radon. Second priority list of exposure factors were 1, 2-dichloroethane, accidents – domestic, accidents – traffic, acrylamide, arsenic, chlorination by-products, carbon monoxide, damp housing, foodborne epidemics, indoor insecticides, methyl mercury, ultraviolet radiation, and waterborne epidemics.
8. The second meetings would be held in June 2009 in Berlin, organized by the WHO Collaborating Centre at the German Federal Environment Agency. National exposure data would be evaluated at the Berlin meeting, and the external review process would be launched in parallel with the DALY modelling.
9. The third meeting would be held in October in Rome, organized by the Italian National Institute of Health and the WHO European Centre for Environment and Health. Estimates for the first priority list stressors would be finalized at the Rome meeting for the contribution to the Fifth Ministerial Conference on Environment and Health in Italy in 2010.

Introduction

Environmental factors endanger human health in many ways. The development of policies for the protection of public health and research programmes to bridge the gaps in our understanding of the relationship between the environment and health both require quantitative estimates of the significance of various hazards. The WHO programme on quantifying environmental health impacts has addressed more than a dozen stressors from a global point of view ⁽¹⁾. WHO has performed a global burden of disease (BoD) quantification and ranking of selected exposures, published in *The World Health Report* ⁽²⁾. To support further applications of the environmental burden of disease (EBD) assessments, WHO published methodological guidance in 2003 ⁽³⁾.

In Europe, EBD assessments are being conducted in several countries. The work by the National Institute for Public Health and the Environment, the Netherlands (RIVM) was one of the first systematic projects in this area in Europe to use disability-adjusted life years (DALYs) as a measure to compare the burden of different health outcomes attributable to environmental factors ⁽⁴⁾. The results highlighted the facts that:

- (i) a number of environmental stressors may cause chronic or acute diseases or death;
- (ii) a few top ranking stressors cause over 90% of the national EBD; and
- (iii) these top ranking stressors are not necessarily those that have attracted the most concern, regulatory action and/or preventive investment.

The WHO European Centre for Environment and Health (ECEH), Bonn, organized a meeting to constitute a project team to support the ongoing national activities in European countries on these topics. The main outcomes of the project will be provide a platform to uphold scientific works, to make the selection of environmental exposures and health endpoints comparable across the countries, and to make assessment methods available to countries that want to pursue the analysis. The project will set up a web site to share the methods and results, as well as to invite new countries to join and update their national data. Initial assessment results from the project will be available for the Fifth Ministerial Conference on Environment and Health, to be held in Italy in 2010.

Project objectives

The objective of the project is to update the previous EBD assessments, to add stressors relevant to the European Region, to provide harmonized EBD assessments for participating countries, and to develop and make available the methodology and databases for other countries.

The specific objectives are to provide:

- full comparability of the quantifications and ranking of the EBDs from environmental exposures between countries and between exposure agents;
- a unified valuation of the different risks; and
- assessments of variation and uncertainty in the input parameters and results.

Both variation and uncertainty of the input data will be evaluated, and carried through the assessments all the way to the results. The project will be carried out using a common plan and protocols. Each participant is responsible for domestic project management and funding. The

project is based on existing data and materials – no field work for collecting new data is anticipated. The overall project duration is 18 months, starting 1 January 2009. A project steering committee is formed from the principal investigators in each participating institute and representatives of WHO. The activities below are proposed.

1. **Environmental exposure agents** to be considered in the assessment are bundled together. The purpose is to cover a range of environmental exposures significant for public health that lead to concern in society, have a high individual risk and/or have a substantial bearing on the economy.
2. **Population exposure/intake/body burden** data are collected nationally, using common criteria and data formats.
3. **The national BoD data** is collected from the WHO database and controlled against, and supplemented when needed with, national health statistics.
4. **Dose/response and relative risks models** are selected jointly from the literature.
5. **DALY valuations** for the different diseases and symptoms are reviewed jointly from the literature.
6. **Analyses and reporting** are carried out both nationally and jointly using agreed methods and reporting formats at both levels.

The above activities will be carried out by four task groups.

- Task group 1 (TG1): National exposure background incidence data
- Task group 2 (TG2): Health endpoints (codes from the International Classification of Diseases tenth revision (ICD-10)¹) and dose-response (D-R) relationships
- Task group 3 (TG3): DALY valuations and EBD modelling
- Task group 4 (TG4): Uncertainty analysis

Criteria for selection of the stressors

Four criteria were defined for selection of exposure factors to be included in the study:

- (iv) public health impact
- (v) high individual risk
- (vi) high public concern
- (vii) economic significance.

Occupational hazards and risks associated with lifestyles (e.g. alcohol, active smoking, nutrition) and infectious diseases were excluded from the assessment.

The meeting was opened by Dr Michal Krzyzanowski. Professor Matti Jantunen was selected as the meeting chairperson and Dr Otto Hänninen as the rapporteur.

Seven presentations were made about the WHO and national activities by Dr Annette Prüss-Üstün (WHO headquarters), Ms Anne Knol (RIVM, the Netherlands), Mr Olli Leino (National

¹ A translation table is provided for ICD-9.

Institute for Health and Welfare (THL), Finland), Mr Tek-Ang Lim (Institute for Public Health Surveillance, France), Dr Odile Mekel (North Rhine-Westphalia Institute of Health and Work, Germany), Professor Paolo Carrer (University of Milan, Italy) and Dr Ivano Iavarone (National Institute of Health, Italy).

Selected exposure factors

Based on the selection criteria, the exposure factors identified for consideration from the previous studies were divided into two priority levels. Those given in Table 1 have a higher priority level and will be considered in the first phase of the project.

Table 1. First priority list of exposure factors

S1	Benzene
S2	Dioxins (including furans and dioxin-like polychlorinated biphenyls)
S3	Environmental tobacco smoke (ETS)
S4	Formaldehyde
S5	Lead
S6	Environmental noise
S7	Ozone
S8	Particulate matter
S9	Radon

Table 2. Second priority list of exposure factors

1,2-Dichloroethane
Accidents – domestic
Accidents – traffic
Acrylamide
Arsenic
Chlorination by-products
Carbon monoxide
Damp housing
Foodborne epidemics
Indoor insecticides
Methyl mercury
Ultraviolet radiation
Waterborne epidemics

Health endpoints and D-R modelling

A tentative list of the health endpoints to be considered for each exposure factor was agreed at the meeting. The D-R task group (TG2) will propose the D-R functions to be used, based on a review of the scientific literature. The D-R models and corresponding definitions of the exposure assessment and related health endpoints with the ICD-10 (with translation table for ICD-9) codes will be made available on the project wiki web site.

S1 Benzene

Health endpoints selected include leukaemia morbidity and mortality (disaggregated by type of leukaemia). Exposure data consists of annual average (i.e. long-term) exposure levels of respiratory and dietary exposures of the population in general. The issue of different risk levels for children and adults should be considered in the project. Paolo Carrer was nominated as coordinator for the benzene data.

S2 Dioxins

Health endpoints selected for dioxins include non-Hodgkin's lymphoma, developmental defects and diabetes. Long-term childhood dietary exposures are used. THL of the Netherlands and the German Federal Environment Agency were selected to coordinate the dioxin data.

S3 Environmental tobacco smoke

Environmental tobacco smoke (ETS) is associated with a large number of relevant health endpoints. Exposures and background risks vary by gender and therefore the data should be collected by gender. The health effects selected include mortality and morbidity attributable to lung cancer and ischaemic heart disease (IHD), sudden infant death, and morbidity attributable to aggravation of asthma, lower respiratory symptoms, and acute otitis media. Exposure data consists of mainly the fraction of homes with smokers, disaggregated by the presence of children (for the child-specific health outcomes). Odile Mekel and Annette Prüss-Üstün were nominated to coordinate the ETS data. The ETS work will rely on the ongoing WHO review of the latest scientific evidence.

S4 Formaldehyde

Health effects selected for formaldehyde were respiratory, skin and eye irritation, nasal cancer and aggravation of asthma caused by short-term and long-term exposures. The work will build on the chapter in the forthcoming WHO publication on housing ⁽⁵⁾ (contact person: Matthias Braubach) and the European Union's INDEX project report ⁽⁶⁾. Paolo Carrer was nominated to coordinate the formaldehyde data.

S5 Lead

Neurocognitive development, cardiovascular diseases (blood pressure) and renal effects were selected as health endpoints for long-term lead exposures, disaggregated by age group: children (developmental effects) and adults (blood pressure). Because of the threshold model, distributional data (main percentiles) are needed for the blood-lead levels. The work will build

on the updated assessment for the United States (contact person: Annette Prüss-Üstün) and the WHO ECEH work on housing EBD (contact person: Matthias Braubach). Marianne Rappolder/André Conrad and Annette Prüss-Üstün were nominated to coordinate the lead data.

S6 Environmental noise

The health effects of environmental noise were selected to cover psychosocial effects (sleep disturbance), cardiovascular effects (elevated blood pressure, IHD including myocardial infarction), and learning performance. Exposure data consists of night-time and 24-hour ambient noise levels. The work will build upon the WHO ECEH work on noise and health (contact person: Rokho Kim). Thomas Classen and Rokho Kim were nominated to coordinate the noise data.

S7 Ozone

Health endpoints for ozone were defined as mortality from respiratory and cardiovascular causes and pneumonia, hospital admissions and emergency room visits resulting from respiratory diseases caused by short-term exposures (eight-hour daily maxima). The work builds upon the WHO Air Quality Guideline update ⁽⁷⁾. Otto Hänninen was selected to coordinate the ozone data.

S8 Particulate matter

Particulate matter (PM) health effects are associated with both short-term and long-term exposure estimates. Mortality outcomes, in particular, are dominated by the long-term exposures, and the additional inclusion of short-term effects would lead to double counting; therefore the main focus for PM was set on long-term exposures (annual population-representative ambient PM_{2.5} and PM₁₀ concentrations as nationally available). The mortality effects include total, cardiopulmonary causes and lung cancer. Additionally morbidity effects include chronic respiratory symptoms in children, chronic bronchitis in adults (long-term exposures) and hospital admissions (cardiovascular and respiratory), emergency room visits (respiratory), aggravation of asthma and respiratory symptoms. The work will build on the WHO Air Quality Guideline update ⁽⁷⁾ (contact person: Michal Krzyzanowski). Matti Jantunen, Annette Prüss-Üstün, Thomas Classen and Ivano Iavarone were nominated to coordinate the PM data.

S9 Radon

Health effects selected for radon include mortality and morbidity attributable to lung cancer associated with long-term average population exposures. The work will build upon the WHO ECEH work on housing and health and the Darby et al. review ⁽⁸⁾. Matti Jantunen and Tek-Ang Lim were selected to coordinate the radon data.

National exposure data

Each participating country is responsible for collecting the national exposure data and national incidence data on the background risks for the selected health endpoints. The key criteria for selecting exposure data from various sources are the representativeness, completeness and current status of the data. The exposure task group (TG1) will collaborate with the health (TG2)

and modelling (TG3) task groups. Templates for the data and information expected from these task groups will be made available on the project wiki web site.

The country-specific DALY data for 2004 is available from WHO. However, the meeting acknowledged that national data for both environmental exposures and health endpoint incidence rates would have to be from later years to be relevant for the Fifth Ministerial Conference. The effects of demographics, especially population ageing, and temporal trends in exposures will be accounted for separately.

Project schedule

The project schedule was organized on the basis of the two priority levels of target exposures. The first priority group exposure data are to be collected in March-May 2009 parallel to the D-R reviews and background health data. The model for DALY calculations will need to be built. These data and models will be reviewed at the second project meeting in Berlin on 25 and 26 June 2009. The Berlin meeting will discuss, among other things, the comparative scenario (exposure decrease by 10%, zero exposure, etc.), the processing of temporal trends, the analysis of uncertainty, and the effects of demographics on the assessment.

First priority group EBD modelling will be conducted parallel to the external review between June and September 2009 and the first results will be reported at the third project meeting in Rome on 22 and 23 October 2009 to make them available for the preparation of the WHO Fifth Ministerial Conference in Parma in 2010.

The exposure, D-R and health data for the second priority list are to be collected in parallel in 2009 as much as practically possible alongside the main priority exposures.

Wiki-site for documentation and data sharing

THL will create a wiki web site for the use of the task groups and national teams for sharing the definitions, models, templates and documentation of the data as well as collection of the data in collaboration with the task group on EBD modelling (TG3).

The web site will specifically include a section for suggesting and discussing the inclusion of new exposures and stressors into the evaluation.

Steering group and task groups

The project steering group was set up to coordinate the project with a representative from each of the participating countries: Annette Prüss-Üstün, Anne Knol, Tek-Ang Lim, Otto Hänninen, Claudia Hornberg, and Paolo Carrer/Ivano Iavarone.

The four task groups set up were given responsibility for development and collaboration in the key areas of the project.

Task group 1: National exposure data

The task group on exposures and other national data (incidence/ prevalence or mortality statistics – where WHO BoD data are not available for specific health endpoints) will develop the templates for the collection of national data and coordinate the collection activities. The task group will define the required distributional and/or mean exposure parameters as well as disaggregation by age, gender, urban/rural and other required factors. The members nominated were Olli Leino, Ivano Iavarone, Anne Knol, Tek-Ang Lim, Andre Conrad, and Otto Hänninen (chair).

Task group 2: Health endpoints and D-R relationships

The task group on D-R relationships will collect the most recent reviews available, updated with the newest scientific literature for characterization of the evidence on the quantitative association between exposures and the selected health outcomes. The selected health outcomes will be defined with ICD-10 (ICD-9) codes in order to facilitate comparison across countries. The objective of the task group is to create non-country-specific general D-R models for each selected exposure–endpoint pair to be used across the participating countries. Additionally, the collection of health-related data on the background risk levels and duration of the target diseases is specified by the task group – the latter only if WHO BoD data is not available for the specific health endpoint. The members of TG2 are Thomas Classen, Annette Prüss-Üstün, Rokho Kim, Marianne Rappolder, and Paolo Carrer (chair).

Task group 3: DALY valuations and EBD modelling

The review of DALY valuations consisting of severity factors for each target health endpoint that is not covered by the WHO BoD database and the final EBD modelling is coordinated by task group 3. The members of TG3 are Marianne Rappolder, Tek-Ang Lim, Anne Knol (chair), Olli Leino, Odile Mekel, Annette Prüss-Üstün, Matti Jantunen, and Ivano Iavarone.

Task group 4: Uncertainty analysis

Data uncertainty is evaluated and collected as part of the national data and the definition of the D-R models. Additionally, one member from each of the other three task groups is nominated to TG4 on uncertainty analysis. The members of TG4 are Olli Leino, Otto Hänninen, Thomas Classen, Anne Knol, and Odile Mekel (chair).

Conclusions

Significant public health impacts are associated with various environmental risk factors. Policy development requires quantitative information on the magnitude of the impacts for efficient allocation of research and abatement resources. The objective of the Environmental Burden of Disease – European countries project is to develop comparative methods for the international assessment of health impacts estimated as disability-adjusted life years (DALYs). Two parallel methodologies are applied, using:

(viii) World Health Organization estimates for the national burden of diseases and attributable fractions; and

(ix) DALY calculations based on incidences, durations and severity factors. The latter more detailed method is applied in conjunction with the life-table method that accounts for the changes in population age structures and utilizes optimally age-specific risk factors.

Environmental stressors were divided into three categories. The priority one category, consisting of 9 stressors (benzene, dioxins, environmental tobacco smoke, formaldehyde, lead, environmental noise, ozone, particulate matter and radon) will be evaluated first, followed by the second priority list of 19 stressors. The third category will consist of identified stressors that will not be evaluated within the current project.

The evaluation process is open and new participants are welcome to join the project. Project information is made available along the progress on a restricted-access web site.

Collected national exposure data will be evaluated at the second project meeting in Berlin on 25 and 26 June 2009, when the external review process will also be launched. The third project meeting, to be held in Rome on 22 and 23 October 2009, will finalize the first priority stressor list estimates to make it available for the Fifth Ministerial Conference on Environment and Health in Italy in 2010.

References

1. Practical guidance for assessment of disease burden at national and local levels [web site]. Geneva, World Health Organization, 2008 (http://www.who.int/quantifying_ehimpacts/national/en/).
2. *The World Health Report 2002: Reducing risks, promoting healthy life*. Geneva, World Health Organization, 2003 (http://www.who.int/whr/2002/en/whr02_en.pdf).
3. Prüss-Üstün A et al. *Introduction and methods: Assessing the environmental burden of disease at national and local levels*. Geneva, World Health Organization, 2003 (Environmental Burden of Disease Series, No. 1) (http://www.who.int/entity/quantifying_ehimpacts/publications/en/9241546204.pdf).
4. de Hollander AEM et al. An aggregate public health indicator to represent the impact of multiple environmental exposures. *Epidemiology*, 1999;10 (5), 606–617.
5. Burden of disease of housing [web site]. Copenhagen, WHO Regional Office for Europe, 2009 (http://www.euro.who.int/Housing/evidence/20080327_5).
6. *The INDEX project: summary on recommendations and management options*. Brussels, European Commission, 2004 (http://ec.europa.eu/health/ph_projects/2002/pollution/fp_pollution_2002_exs_02.pdf).
7. *WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide: Global update 2005*. Geneva, World Health Organization, 2006 (http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf).
8. Darby S et al. Radon in homes and risk of lung cancer: collaborative analysis of individual data from 13 European case-control studies. *British Medical Journal*, 2005 330:223, doi:10.1136/bmj.38308.477650.63 (<http://www.bmj.com/cgi/content/abstract/bmj.38308.477650.63v1>).

Further reading

1. *Burden of disease methods: analytic reflections. Chapter 1.* Geneva, Global Forum of Health, 2006 (www.globalforumhealth.org/filesupld/BOD/Chap1_BOD.pdf).
2. de Hollander A et al. An aggregate public health indicator to represent the impact of multiple environmental exposures. *Epidemiology*, 1999, 10(5):606–617 (http://www.who.int/quantifying_ehimpacts/methods/en/hollander.pdf).
3. Environmental burden of disease series [web site]. Geneva, World Health Organization, 2003–2009 (http://www.who.int/quantifying_ehimpacts/national/en/).
4. Environmental burden of disease: Country profiles [web site]. Geneva, World Health Organization, 2007 (http://www.who.int/quantifying_ehimpacts/countryprofiles/en/index.html).
5. *Glossary of terms for the EBD series.* Geneva, World Health Organization, 2003 (http://www.who.int/quantifying_ehimpacts/publications/en/9241546204glos.pdf).
6. *Indoor air pollution: National burden of disease estimates.* Geneva, World Health Organization, 2007 (http://www.who.int/indoorair/publications/indoor_air_national_burden_estimate_revised.pdf).
7. *Introduction and methods. Assessing the environmental burden of disease at national and local levels.* Geneva, World Health Organization, 2003 (Environmental Burden of Disease series, No. 1) (http://www.who.int/entity/quantifying_ehimpacts/publications/en/9241546204.pdf).
8. Lanzieri G. *Population in Europe 2007. First results.* Brussels, European Commission, 2008 (Eurostat Statistics in focus, 81/2008) (http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-08-081/EN/KS-SF-08-081-EN.PDF).
9. Lopez A et al. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *Lancet*, 2006, 367:1747–1757 (<http://www.thelancet.com/journals/lancet/article/PIIS0140673606687709/fulltext>).
10. Melse M et al. A National Burden of Disease Calculation: Dutch Disability-Adjusted Life-Years. *American Journal of Public Health*, 90(8):1241–1247 (<http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=1446331&blobtype=pdf>).
11. *Mortality Target Monitoring. Update to include data for 2007.* London, United Kingdom Department of Health, 2008 (http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsStatistics/DH_088867?IdcService=GET_FILE&dID=174003&Rendition=Web).
12. Murray CJL et al., eds. *Comparative quantification of health risks.* Geneva, World Health Organization, 2004 (http://www.who.int/healthinfo/global_burden_disease/cra/en/index.html).
13. Prüss-Üstün A, Bonjour S, Corvalán C. The impact of the environment on health by country: a meta-synthesis. *Environmental Health*, 2008, 7:7 (<http://www.ehjournal.net/content/7/1/7>).
14. Prüss-Üstün A, Corvalán C. *Preventing disease through healthy environments. Towards an estimate of the environmental burden of disease.* Geneva, World Health Organization, 2006 (http://www.who.int/quantifying_ehimpacts/publications/preventingdisease/en/index.html).

15. Schwarzing M. Cross-national agreement on disability weights: the European Disability Weights Project. *Population Health Metrics*, 2003, 1(9)
(<http://www.pophealthmetrics.com/content/1/1/9>).
16. Smith K, Mehta S. The burden of disease from indoor air pollution in developing countries: comparison of estimates. *International Journal of Hygiene and Environmental Health*, 2003, 206:279–289
(http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B7GVY-4DS75H1-7C&_user=3824252&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000055308&_version=1&_urlVersion=0&_userid=3824252&md5=17011752273073538794b46184f2361f).
17. Smith K. National burden of disease in India from indoor air pollution. *Proceedings of the National Academy of Sciences*, 2000, 97(24):13286–13293
(<http://www.pnas.org/content/97/24/13286.full.pdf+html>).
18. *The global burden of diseases, injuries, and risk factors study, Operations manual, final draft January 31, 2008*. Washington, DC, Institute for Health Metrics and Evaluation at the University of Washington, 2008
(http://www.globalburden.org/GBD_Study_Operations_Manual_Jan_31_2008.pdf).

Annex 1

Final programme

Thursday 12 February 2009

- 11:30–12:00 Registration
- 12:00–12:15 Welcome, introduction of the participants, selection of the meeting chairperson and rapporteur
- 12:15–13:45 Presentations about the respective WHO and national activities
- Annette Prüss-Üstün, WHO
 - Anne Knol, RIVM
 - Olli Leino, THL
 - Tek-Ang Lim, InVS
 - Odile Mekel, LIGA
 - Paolo Carrer, University of Milano
 - Ivano Iavarone, ISS, Rome
- 13:45–14:00 Introduction of the project objectives, draft work-plan, initial list of exposures, tasks and schedule (Matti Jantunen)
- 14:00–15:00 Discussion and agreement about the general work-plan and timetable
- 15:00–15:30 *Coffee break*
- 15:30–15:45 Selection of the Project Steering Group
- 15:45–16:30 Discussion and agreement about the project tasks and initial list of exposures
- 16:30–17:00 Nomination of the task group members (exposure data, D/R data and models, attributable risk data, DALY-valuations, EBD modelling)
- 17:00–19:00 General discussion and introduction to the second day's work in task groups
- 19:00 *Informal dinner at Zur Lese restaurant (optional)*

Friday 13 February 2009

- 9:00–10:00 Plenary: Presentation and discussion of the short list of exposures and selection of health endpoints and relevant exposures characteristics
- 10:00–12:00 Tasks of the small groups (TG1 exposure, TG2 health, TG3 methodology):
Discussion and suggestions on objectives, criteria, division of tasks, deliverables, schedule
- 12:00–12:30 Consensus and summary of the meeting
- 12:30 Closing/Michal Krzyzanowski
Lunch (optional)

Annex 2

List of participants

Temporary advisers

Finland

Dr Otto Hänninen

Department of Environmental Health, National Institute for Health and Welfare (THL)

Professor Matti Jantunen

Department of Environmental Health, National Institute of Health and Welfare (THL)

Mr Olli Leino

National Institute for Health and Welfare (THL)

France

Mr Tek-Ang Lim

Epidemiologist, Department of Environmental Health, French Institute for Public Health Surveillance

Germany

Dr Thomas Classen

Department of Environment and Health, Bielefeld School of Public Health

Mr Andre Conrad

Federal Environment Agency (Umweltbundesamt)

Dr Odile Mekel

NRW Institute of Health and Work, Center for Public Health

Ms Marianne Rappolder

Section II 1.1 Environmental Hygiene, Environmental Medicine, Health Effects Assessment, Federal Environment Agency

Italy

Professor Paolo Carrer

Department of Occupational and Environmental Health, University of Milan

Dr Ivano Iavarone

Environmental Epidemiology Unit, Department of Environment and Primary Prevention
Italian National Institute of Health (ISS)

Netherlands

Ms Anne Knol

National Institute of Public Health and the Environment (RIVM)

World Health Organization

Headquarters

Dr Annette Prüss-Üstün

Regional Office for Europe

Dr Rokho Kim

Secretariat

Ms Deepika Sachdeva

Intern

Mr Joohwan Lee