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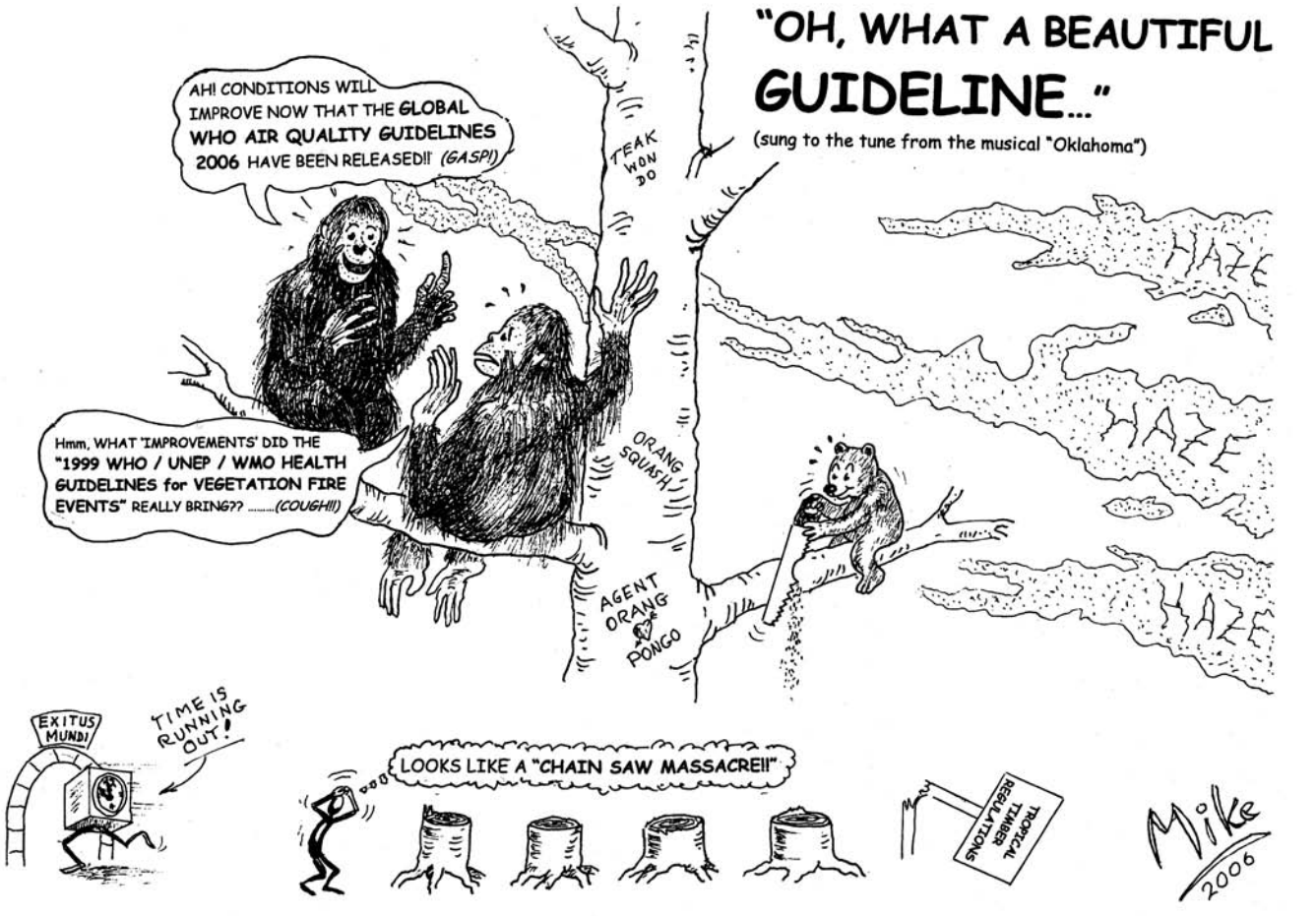

HEALTH IMPACT ASSESSMENT OF BLACK SMOKE AND AIRBORNE PARTICULATES ON ZAGREB POPULATION

Kresimir Šega and Ivan Bešlić

INTRODUCTION

The relationship between different air pollutant concentrations and health impacts on the population living in a monitored area has been widely studied during past decades (Aunan 1995; WHO 2004). During episodes characterised by short-term elevated pollutant concentrations this relationship is quite obvious and it is easily studied by means of standard statistical methods. Assessment of this relationship during the conditions of long-lasting exposure to low concentration levels needs well trained and educated personal, huge and complete databases, control over a number of confounders like epidemics, specific meteorological situations, seasonality, weekly concentration rhythms etc. Investigations performed on urban Zagreb population were based on concentration time-series and the incidences of health endpoints found in this population (Šimić et al. 2000, 2001, 2002; Pavlović et al. 1997).

In this study health impacts on Zagreb population were estimated by means of the procedures and coefficients developed as the results obtained in a number of meta-studies performed on populations all over the world and used by WHO (WHO 2004). Health impact assessments were performed for the period 2000 – 2005 and present the continuation of previous investigations (Šega 2000; Šega et al. 2001).

MATERIALS AND METHODS

Health impact estimation of particulate air pollution on Zagreb population was performed by means of the computer programme 'AirQ' developed by the WHO European Centre for Environment and Health.

Table 1: Health impact incidences (I) and relative risks (RR) of black smoke (BS), total suspended particulates (TSP) and particle size fractions PM_{10} and $PM_{2.5}$ for concentration rise of 10 μg/m^3.

Pollutant	Health impact	I	RR (95 %)
BS	Total mortality	1013	1.0026 (1.0018-1.0034)
	Cardiovascular mortality	497	1.004 (1.002-1.008)
	Respiratory mortality	66	1.008 (1.004-1.014)
	Hospital admission – COPD	101.4	1.0061 (1.002-1.012)
	Hospital admission – respiratory diseases 15-64	66	1.0056 (1.0012-1.0102)
	Hospital admission – asthma < 15	100	1.006 (1.000-1.017)
	Hospital admission – asthma 15-64	66	1.0042 (1.0000-1.0118)
	Acute myocardial infarction	132	1.016 (1.0053-1.0290)
TSP	Total mortality	1013	1.003 (1.002-1.007)
	Cardiovascular mortality	497	1.002 (1.000-1.006)
	Respiratory mortality	66	1.008 (1.002-1.018)
	Hospital admission – COPD	101.4	1.0044 (1.0000-1.0094)
PM_{10}	Total mortality	1013	1.0074 (1.0062-1.0086)
	Cardiovascular mortality	497	1.008 (1.005-1.018)
	Respiratory mortality	66	1.012 (1.0048-1.0370)
	Hospital admission – respiratory diseases	1260	1.008 (1.0048-1.0112)
	Hospital admission – cardiovascular diseases	436	1.009 (1.006-1.013)
	Asthma attacks in children		1.051 (1.047-1.055)
	Asthma attacks in adults		1.004 (1.000-1.008)
$PM_{2.5}$	Total mortality	1013	1.015 (1.011-1.019)

Health impacts of certain air pollutant estimations are calculated taking into account relative risk, mortality and morbidity of certain population subgroups. The quantification of health risks is based on the concept of attributable risk proportion (AP), i.e. the proportion of a risk which could be attributed to the exposure to certain pollutant by simultaneous control over possible confounders. Attributable risk proportion estimation procedure was suggested (Krzyzanowski 1997). The principle of the programme 'AirQ' is: one population – one set of exposures for a given period.

Air pollutant concentrations measured at all sampling sites representative for a given population are recalculated by defined procedures to obtain one set of data which is further used for estimation of health impact incidences.

In Table 1 incidences and relative risks of certain health impacts (population of 100.000) for a concentration increase of 10 µg/m³ are shown, together with their 95% confidence intervals. Because for particulate air pollutants no observed or expected threshold value is known, the programme 'AirQ' uses a threshold of 10 µg/m³ (C<10 µg/m³ → RR=1).

For the period 2000 - 2004 time series of particulate pollutant concentrations measured at Zagreb monitoring network were used (BS at 6, TSP at 2, PM_{10} and $PM_{2.5}$ at 1 monitoring site). In the year 2005 a new $PM_{2.5}$ monitoring network was established so the samples of $PM_{2.5}$ particle fraction were collected at five monitoring sites. Measured concentrations were normalized to standard conditions of air pressure and temperature.

Table 2: Health impacts of black smoke in Zagreb population during the period 2000 – 2005, number of additional cases (population size 100.000) and attributable proportions together with their 95% confidence intervals.

Number of cases in 100 000 /#Attributable proportion /%						
Year	**Total mortality**					
2000	**5.3**	3.7	6.9	**0.52**	0.36	0.68
2001	**4.9**	3.4	6.4	**0.49**	0.34	0.64
2002	**4.6**	3.2	5.9	**0.45**	0.31	0.59
2003	**5.0**	3.4	6.5	**0.49**	0.34	0.64
2004	**3.8**	2.7	5.0	**0.38**	0.26	0.49
2005	**5.4**	3.8	7.1	**0.53**	0.37	0.70
	Cardiovascular mortality					
2000	**4.0**	2.0	7.9	**0.80**	0.40	1.60
2001	**3.7**	1.9	7.4	**0.75**	0.37	1.48
2002	**3.4**	1.7	6.8	**0.69**	0.35	1.37
2003	**3.7**	1.9	7.4	**0.75**	0.38	1.49
2004	**2.9**	1.4	5.7	**0.58**	0.29	1.15
2005	**4.1**	2.0	8.1	**0.82**	0.41	1.63
	Respiratory mortality					
2000	**1.1**	0.5	1.8	**1.60**	0.80	2.76
2001	**1.0**	0.5	1.7	**1.48**	0.75	2.56
2002	**0.9**	0.5	1.6	**1.37**	0.69	2.37
2003	**1.0**	0.5	1.7	**1.49**	0.75	2.58
2004	**0.8**	0.4	1.3	**1.15**	0.58	2.00
2005	**1.1**	0.5	1.9	**1.63**	0.82	2.81
	Hospital admission – respiratory diseases (15-64 years)					
2000	**0.7**	0.2	1.3	**1.12**	0.24	2.03
2001	**0.7**	0.1	1.2	**1.04**	0.23	1.88
2002	**0.6**	0.1	1	**0.96**	0.21	1.74
2003	**0.7**	0.1	1.3	**1.05**	0.23	1.89
2004	**0.5**	0.1	1.0	**0.81**	0.17	1.46
2005	**0.8**	0.2	1.4	**1.14**	0.25	2.06

Number of cases in 100 000 /#Attributable proportion /%						
Year	**Hospital admission – asthma (<15 years)**					
2000	**1.2**	0.0	3.3	**1.20**	0.00	3.33
2001	**1.1**	0.0	3.1	**1.12**	0.00	3.10
2002	**1.0**	0.0	2.9	**1.03**	0.00	2.87
2003	**1.1**	0.0	3.1	**1.12**	0.00	3.12
2004	**0.9**	0.0	2.4	**0.87**	0.00	2.42
2005	**1.2**	0.0	3.4	**1.22**	0.00	3.39
	Hospital admission – asthma (15-64 years)					
2000	**0.6**	0.0	1.5	**0.84**	0.00	2.34
2001	**0.5**	0.0	1.4	**0.78**	0.00	2.17
2002	**0.5**	0.0	1.3	**0.72**	0.00	2.01
2003	**0.5**	0.0	1.4	**0.79**	0.00	2.19
2004	**0.4**	0.0	1.1	**0.61**	0.00	1.69
2005	**0.6**	0.0	1.6	**0.86**	0.00	2.38
	Hospital admission – COPD					
2000	**1.4**	0.4	2.4	**1.40**	0.40	2.38
2001	**1.3**	0.4	2.2	**1.30**	0.37	2.21
2002	**1.2**	0.4	2.1	**1.20**	0.35	2.04
2003	**1.3**	0.4	2.3	**1.31**	0.38	2.22
2004	**1.0**	0.3	1.7	**1.01**	0.29	1.72
2005	**1.3**	0.4	2.5	**1.24**	0.41	2.42
	Acute myocardial infarction					
2000	**5.1**	1.6	8.8	**3.90**	1.22	6.66
2001	**4.8**	1.5	8.2	**3.62**	1.13	6.21
2002	**4.4**	1.4	7.6	**3.36**	1.05	5.76
2003	**4.8**	1.5	8.2	**3.65**	1.14	6.25
2004	**3.7**	1.2	6.4	**2.83**	0.88	4.88
2005	**4.2**	1.4	4.5	**3.20**	1.08	5.65

Results and Discussion

Estimated additional number of cases, attributable proportion and their 95% confidence intervals for health impacts of particulate air pollutants during the period 2000 - 2005 are presented in Tables 2 to 5. In Table 2 the health impact frequencies of black smoke in Zagreb population are presented. Since black smoke as a general air pollutant has been studied for decades, a number of health impact endpoints could be estimated. The results show low levels of incidence as a consequence of low BS concentrations in Zagreb air (annual mean range for six measuring sites 17-33 µg/m³). As opposite to the period 1976 - 2000 no negative trend in health impacts can be observed since the concentration levels stabilized during last years.

Table 3: Health impacts of total suspended particulate matter in Zagreb population during the period 2000 – 2005, number of additional cases (population size 100.000) and attributable proportions together with their 95% confidence intervals.

Number of cases in 100 000 /#Attributable proportion /%						
Year	**Total mortality**					
2000	**10.5**	4.0	24.1	**1.03**	0.69	2.38
2001	**8.2**	5.5	18.9	**0.81**	0.54	1.87
2002	**9.9**	6.7	22.9	**0.98**	0.66	2.26
2003	**12.4**	8.3	28.5	**1.22**	0.82	2.81
2004	**11.7**	7.8	26.9	**1.16**	0.77	2.66
2005	**11.1**	7.4	25.6	**1.10**	0.74	2.54
	Cardiovascular mortality					
2000	**3.4**	0.0	10.2	**0.69**	0.0	2.05
2001	**2.7**	0.0	8.0	**0.54**	0.0	1.61
2002	**3.3**	0.0	9.7	**0.66**	0.0	1.94
2003	**4.1**	0.0	12.0	**0.82**	0.0	2.42
2004	**3.8**	0.0	11.4	**0.77**	0.0	2.29
2005	**3.7**	0.0	10.8	**0.74**	0.0	2.18
	Respiratory mortality					
2000	**1.8**	0.9	3.9	**2.71**	1.37	5.90
2001	**1.4**	0.7	3.1	**2.13**	1.08	4.67
2002	**1.7**	0.9	3.7	**2.58**	1.30	5.61
2003	**2.1**	1.1	4.6	**3.20**	1.62	6.92
2004	**2.0**	1.0	4.3	**3.02**	1.54	6.56
2005	**1.9**	1.0	4.1	**2.89**	1.47	6.28
	Hospital admission – COPD					
2000	**1.5**	0.0	3.2	**1.51**	0.0	3.17
2001	**1.2**	0.0	2.5	**1.18**	0.0	2.50
2002	**1.5**	0.0	3.1	**1.43**	0.0	3.01
2003	**1.8**	0.0	3.8	**1.78**	0.0	3.74
2004	**1.7**	0.0	3.6	**1.69**	0.0	3.54
2005	**1.6**	0.0	3.4	**1.61**	0.0	3.38

Table 4: Health impacts of PM_{10} particle size fraction in Zagreb population during the period 2000 – 2005, number of additional cases (population size 100.000) and attributable proportions together with their 95% confidence intervals.

Number of cases in 100 000 /#Attributable proportion /%						
Year	**Total mortality**					
2000	**23.8**	20.0	27.6	**2.35**	1.98	2.72
2001	**21.9**	18.4	25.4	**2.16**	1.82	2.51
2002	**22.6**	19.0	26.1	**2.23**	1.88	2.59
2003	**23.9**	20.1	27.7	**2.37**	1.99	2.74
2004	**20.1**	16.9	23.3	**1.98**	1.67	2.30
2005	**24.4**	20.5	28.2	**2.40**	2.02	2.78
	Cardiovascular mortality					
2000	**12.6**	8.0	27.5	**2.54**	1.60	5.53
2001	**11.6**	7.3	25.4	**2.34**	1.47	5.11
2002	**11.9**	7.5	26.1	**2.41**	1.52	5.27
2003	**12.7**	8.0	27.6	**2.55**	1.61	5.57
2004	**10.6**	6.7	23.3	**2.14**	1.35	4.69
2005	**12.9**	8.1	28.1	**2.59**	1.64	5.65
	Respiratory mortality					
2000	**2.5**	1.0	7.1	**3.76**	1.54	10.74
2001	**2.3**	0.9	6.6	**3.46**	1.41	9.96
2002	**2.4**	1.0	6.7	**3.57**	1.46	10.25
2003	**2.5**	1.0	7.1	**3.78**	1.55	10.81
2004	**2.1**	0.9	6.1	**3.18**	1.30	9.19
2005	**2.5**	1.7	7.2	**3.84**	2.59	10.97
	Hospital admission – respiratory diseases					
2000	**22.5**	13.6	31.3	**1.83**	1.11	2.55
2001	**19.9**	12.0	27.7	**1.61**	0.97	2.23
2002	**20.9**	12.6	29.0	**1.70**	1.03	2.37
2003	**22.6**	13.7	31.5	**1.84**	1.11	2.55
2004	**17.6**	10.6	24.5	**1.45**	0.87	2.01
2005	**32.7**	19.8	45.3	**2.59**	1.57	3.59
	Hospital admission – cardiovascular diseases					
2000	**12.4**	8.3	17.7	**2.84**	1.91	4.06
2001	**11.4**	7.7	16.3	**2.62**	1.76	3.74
2002	**11.8**	7.9	16.8	**2.70**	1.82	3.86
2003	**12.4**	8.4	17.8	**2.86**	1.93	4.08
2004	**10.5**	7.0	15.0	**2.40**	1.61	3.43
2005	**12.5**	8.5	18.1	**2.91**	1.96	4.15
	Asthma attacks in children					
2000				**14.23**	13.26	15.17
2001				**13.23**	12.32	14.12
2002				**13.61**	12.67	14.52
2003				**14.31**	13.34	15.26
2004				**12.24**	11.39	13.07
2005				**14.51**	13.53	15.48
	Asthma attacks in adults					
2000				**1.28**	0.00	2.54
2001				**1.18**	0.00	2.34
2002				**1.22**	0.00	2.41
2003				**1.29**	0.00	2.55
2004				**1.08**	0.00	2.14
2005				**1.31**	0.00	2.59

In Table 3 the health impact frequencies of total suspended particulate matter in Zagreb population are presented. As opposite to the period 1976 - 2000 no negative trend on health impacts can be observed since the concentration levels stabilized during last years (annual mean range for two measuring sites 32-63 µg/m³).

In Table 4 the health impact frequencies of PM_{10} particle size fraction in Zagreb population are presented. Since PM_{10} fraction contribution to TSP is around 70% the results are much higher compared to those presented in Table 3 (annual mean range 32-38 µg/m³ – one sampling site).

In Table 5 the health impact frequencies of $PM_{2.5}$ particle size fraction in Zagreb population are presented. For the period 2000 - 2004 $PM_{2.5}$ particle fraction was collected at one sampling site only, so for the comparison purpose results for the year 2005 are presented in two lines, for one and five monitoring sites respectively. It turned out that the monitoring site active through the whole period measured the lowest concentrations (annual mean range for 25-29 µg/m³). When all monitoring sites are included into the calculation, the number of additional cases and attributable proportion increased even more (annual mean range for four additional measuring sites 35-41 µg/m³). Since $PM_{2.5}$ fraction content in TSP and PM_{10} is high the results obtained are much higher compared to those presented in Table 3 and Table 4.

Table 5: Impact of $PM_{2.5}$ particle size fraction on total mortality in Zagreb population during the period 2000 – 2005, number of additional cases (population size 100.000) and atributable proportions together with their 95% confidence intervals.

	Number of cases in 100 000 /#Attributable proportion /%					
Year	Total mortality					
2000	**32.2**	23.8	40.5	**3.18**	2.35	3.99
2001	**31.7**	23.5	39.9	**3.14**	2.32	3.95
2002	**31.6**	23.4	39.7	**3.12**	2.31	3.92
2003	**34.7**	25.7	43.6	**3.43**	2.54	4.30
2004	**26.5**	19.6	33.3	**2.98**	2.21	3.75
2005/1	**36.4**	27.0	45.7	**3.60**	2.66	4.51
2005/5	**41.9**	31.0	52.5	**4.13**	3.06	5.18

It is obvious, compared to the effects of other particulate pollutants, that the strongest positive effect will be achieved by lowering $PM_{2.5}$ particle fraction concentrations so this issue should be given the priority in the near future. To observe respective clean air policies and measures $PM_{2.5}$ monitoring network consisting of five measuring sites was established in Zagreb.

Conclusions

Estimation of health endpoints frequencies for Zagreb population was performed by means of the WHO/Euro computer programme 'AirQ'. Time series of black smoke (BS), total suspended particulate matter (TSP), PM_{10} and $PM_{2.5}$ particle fractions daily concentrations measured at Zagreb network stations were used. As opposite to the period 1976 - 2000 no negative trend of health impacts is observed for black smoke and total suspended particulate matter since the concentration levels stabilized during last years. The results show that air pollution caused by black smoke, as the consequence of low mass concentrations, do not represent serious threat for the health in Zagreb population.

Because of the high mass content of PM_{10} and $PM_{2.5}$ particle fractions in the mass of total particulates, their impact on the health in Zagreb population is significant. The strongest effect on health impacts of particulate air pollution in Zagreb will be achieved by reducing $PM_{2.5}$ particle fraction concentrations, so this issue should be given the priority in the future.

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SIMILARITIES AND DIFFERENCES IN AIRBORNE PARTICULATE MATTER: EXPOSURE AND HEALTH EFFECTS OVER EUROPE

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Introduction

The impact of airborne particles on human health is currently seen as the most important environmental issue in Europe. Recent assessments showed an expected loss in life expectancy of about 9 months in the year 2000 (EU-25, central CAFE baseline estimate; Baseline Scenarios for the Clean Air for Europe (CAFE) Programme, M. Amann et al., Final Report to DG ENV, Feb. 2005) due to exposure to (ambient) $PM_{2.5}$ mass. The revisions of the Air Quality Directive and its daughter directives were discussed recently at the European Commission which form the background for a conference of the European Cooperation in the field of Scientific and Technical Research/COST activity 633 'Particulate Matter: Properties related to Health Effects', held from 3 to 5 April 2006 in Vienna, Austria. Various scientific areas covering a range of sciences from physics, chemistry, meteorology, engineering, toxicology, to epidemiology are necessary when tackling the still wide open issues in the research on particulate matter (PM). Scientists with the diverse scientific background coming from all over Europe discussed "Similarities and differences in airborne particulate matter: Exposure and health effects over Europe" in five interactive workshops, which are described in the following.

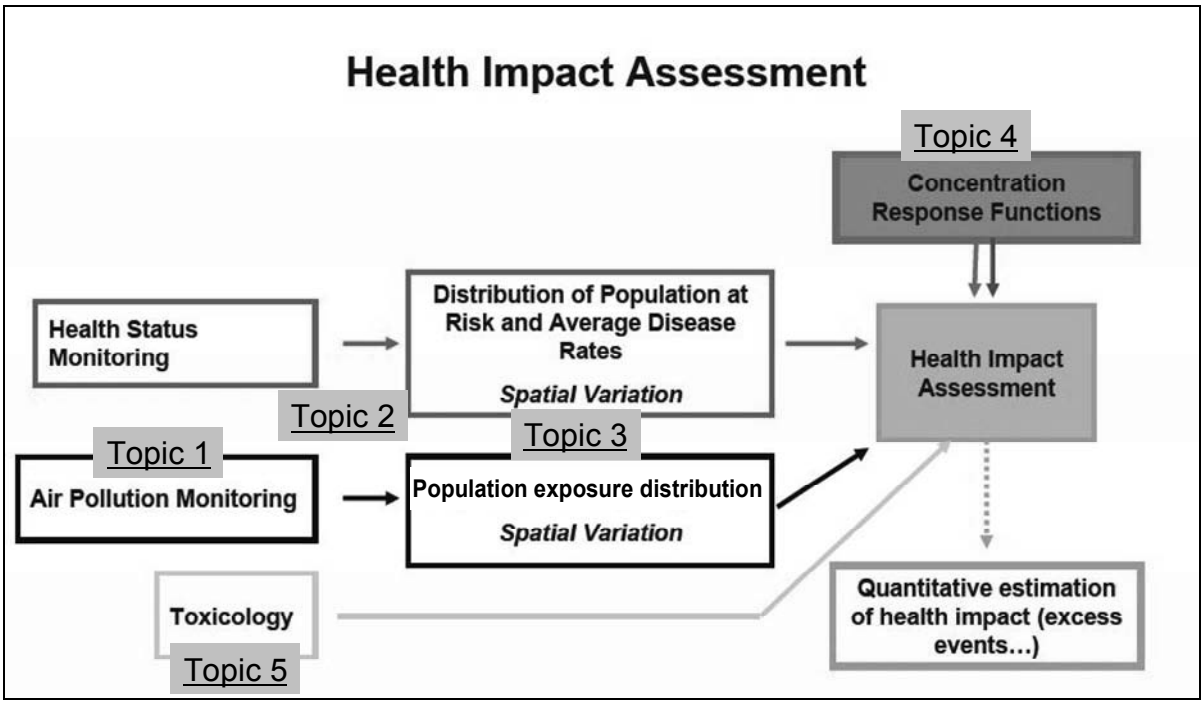

Figure 1: Scheme for Health Impact Assessment
(Taken from 'Analysis and Design of Local Air Quality Measurements: Towards European Air Quality Health Effect Monitoring' T. Kuhlbusch et al., Report to DG ENV, April 2006, http://www.iuta.de/Verfahrenstechnik/Luftreinhaltung/luftpub_download.htm).

Figure 1 shows a flow chart on information and research areas necessary to assess the health impact of airborne PM. It also illustrates how the workshop topics fit into this overall scheme.

Two major issues were clearly stated by all participants of the conference:

- There has been a tremendous increase in knowledge related to airborne particles and their effects on human health over the last decade: the complexity of PM is recognised and requires both new metrics and better understanding of source contributions for effective policy measures.

- Still, major knowledge gaps remain and it is seen that integrated approaches combining the different scientific areas covering environmental, socio-economic and medical research in selected regions in Europe are a prerequisite to effectively tackle the uncertainties European wide.

Workshop topic 1:
Particle characterisation and characteristics

Several major issues came up during the discussions on particle characteristics and characterisation. One block of recommendations is linked to monitoring. Specific needs were identified concerning:

- Extension of the current monitoring network. Additional particle parameters should be measured and this with preference in urbanized areas.

- Improvement of PM mass measurement accuracy. Notably, the reference method EN12341 suffers from sampling artefacts and analytical bias.

- Standardisation of analytical methods for aerosol measurements that cannot be validated because standards do not exist (e.g. EC, particle number concentration).

These points would be best addressed by setting up at least 3 aerosol (super) sites in urban areas located in different regions of Europe.

Such (super) sites would achieve a complete characterisation of the urban aerosol in relation with health effects, and serve as platforms for instrument calibrations and intercomparisons. Further important recommendations are:

- Development of novel analytical capabilities related to aerosol-and-health, e.g. PM oxidative stress potential, reactivity or the surface area of the particles' insoluble core.

And with specific relevance to policy:

- Assessment of how pollutant emission abatement strategies affect PM characteristics.
- Guidance on the selection of new parameters to be measured for monitoring the health effects of PM.

Workshop topic 2: Sources of PM

The second Workshop was focused on sources of airborne particulates and their assessment. The importance of source apportionment in view of health effects and planning of abatement strategies was clearly stated. The following issues were identified to be of high importance for the future directions of source apportionment:

- A need for the development of a common methodology for certain questions/tasks, which shall be validated by comparison with secondary information and/or other methods.
- Combination of emission inventories, chemical transport models and source apportionment methods into an integrated approach. While each tool separately is not capable of answering all questions, in combination they may provide a more detailed insight into issues such as regional variability of contributions by traffic, wood burning, etc.
- The quantification of wood burning as a PM source is a concern for emission inventories. Source apportionment studies are necessary for verifying or rejecting the current statistics reported across the EU.
- One of the biggest challenges for source apportionment studies are secondary organic aerosols (SOA). Current knowledge on their formation processes and the influence of natural or anthropogenic precursors is limited. Smog chamber experiments, modelling studies or the study of their polymerisation processes are necessary for significant improvements.

Linking source apportionment and health effect studies was identified to be of specific importance which should include the following points:

- Separate focus on the coarse and fine grain-size fractions, given that the health effects associated with these two fractions need to be differentiated (respiratory vs. cardiovascular).
- Extension to particle number concentrations, namely ultra fine particles.
- Short- and long-term health effect studies should be linked to source apportionment studies, thereby facilitating the identification of possibly harmful sources and particle properties.
- Following recommendation is given with specific regards to policy issues.
- Source apportionment studies shall be conducted for verification of the effects of the various European and local abatement efforts.

Workshop topic 3:
Modelling and (personal) exposure

Within the third workshop the linkage of measurements of (personal) exposure and how modelling can facilitate this linkage have been discussed intensively. The recommendations are:

- There is a need to assess the uncertainty of existing models rather than to develop new models.
- Long-term exposure estimates need to be improved and developed, especially taking the indoor situation into account.

- Outdoor-indoor penetration of particles and their life time as well as indoor sources and their association with health effects require further investigations.
- Air quality models should be used to complement monitoring data allowing a better spatial distribution characterisation and hence enable improved exposure assessments.
- Exposure studies in Europe should take into account the different characteristics of climate zones, the specific behaviour of social groups, and regional habits.

Specific recommendations regarding the development of policy measures were identified to be:

- Assessment of transboundary transport of PM with advanced air quality models
- Increase number of PM parameters in air quality model outputs to include more health relevant parameters e.g. trace constituents, source contributions, ultra fines.
- Guideline values based on exposure rather than ambient concentrations are needed to improve public health.

Workshop topic 4:
Health effects - Epidemiology

The last two workshops were focused on health effects related to PM exposure. Epidemiology, its possibilities and limitations were discussed in the fourth workshop. The outcomes of this discussion are summarized in the statements below identifying future needs and possible directions.

- Physicochemical differences of particles need to be better defined and incorporated into health effect models that include genetic and socio-economic differences.
- Development of high resolution spatial exposure models for the estimation of chronic, long-term particle exposure; studies in selected regions in Europe on long-term effects of air pollution with standardized procedures in both health and exposure assessment are needed. To appropriately investigate chronic effects, such studies must focus on early pathophysiological or functional markers of chronic diseases rather than on terminal outcomes.
- Inclusion of socio-economic and genetic differences in studies on exposure-response relationships between air pollution and pulmonary, cardiovascular or neurodegenerative diseases. The interrelation between socio-economic factors and the biologically relevant co-factors are poorly understood in different regions of Europe and need to be integrated in future air pollution research.
- Development of dosimetry models that can be used to refine the exposure-response function and for studying effects in secondary organs.
- Investigation of the consistency of concentration-dose-effect estimates for different sources, constituents, and European regions.

Major issues related to the development of policy measures needs are seen to be:

- Abatement strategies need to be evaluated by integrated health effect studies concurrently with the time line of their integration.
- Integrated short-term health effect studies linking health effects and sources are needed to identify their potential hazards. This will allow an initiation of new effective measures.

Workshop topic 5:
Health effects - Toxicology

The fifth Workshop dealt with health effects mainly from the toxicological point of view. Clear concepts on how particles interact with human health were presented while major gaps were identified at the same time. Further needs of developments are foreseen in the following areas:

- Better integration of toxicology and epidemiology, using for instance same health indicators (biomarkers of effect).
- Conduct source related toxicological studies preferably using real world mixed samples of different regions of Europe.
- Long term exposure studies (that can also be used as toxicology-time series studies). Better animal models with the challenge for developing and using transgenic mouse models.
- Development of a test battery for oxidative stress that can ultimately be used to monitor the biological reactivity of air pollution in different regions of Europe.
- Development of tests to evaluate the effectiveness of control strategies e.g. for vehicle and wood combustion emissions.
- The role of the surface area of (the insoluble core of) PM has to be identified.
- The role of so-called non-toxic components (often also referred as "natural") in the total mixture of PM in view of health effects is still insufficiently studied. Can such particles become relevant carriers of toxic or allergenic substances?
- Integration of air sampling in toxicological studies: Usage of PM sampling techniques that reduces sampling artefacts to a minimum such that it approaches the real-world situation of PM in the human airways.

Policy relevance was explicitly seen in the guidance on additional measures and abatement strategies from specific sources and in the explanation / increased confidence on biological plausibility and causal relationship by toxicology.

The need of collaboration and interdisciplinary approaches became obvious during the final conference discussion. Several urgent research needs were identified in the above mentioned research areas. All members of COST 633 and participants of the workshops recommended to conduct well organized concerted research studies in several regions in Europe comprising monitoring and research of air quality, exposure, health status, exposure-response functions, source specific toxicological studies as well as evaluation of abatement actions.

The full report as well as more detailed information on the COST 633 Action can be found on:
http://www2.dmu.dk/atmosphericenvironment/COST633/CostConference2006.asp .

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THE CAPACT PROJECT: COAL USE AND AIR POLLUTION IN CENTRAL ASIA

Bo Libert

Air pollution, in particular from the energy sector and transport, is a significant problem in Central Asia. Coal and lignite are important energy resources for Central Asia. With the economic growth, the dependence on solid fuels for power generation is increasing – solid fuels are cheap and a readily available source of energy. In Kazakhstan as in Uzbekistan, there are plans to increase the countries´ annual coal production. In Uzbekistan, according to the objectives of the National Energy Strategy 2000-2010, coal will significantly increase its share in the energy mix.

However, coal has the highest carbon content of all the fossil fuels (coal, oil and gas) and without appropriate pollution control has the greatest negative impact on the environment. The use and implementation of cleaner coal technologies are essential for the environment. In many cities air pollution levels are also high due to an intensifying car transport with a significant impact on the health of the population. Almaty, the largest city of Kazakhstan, is one example. As it is situated in a valley close to a major mountain range, the air pollution tends to accumulate in the city.

Regional cooperation on air pollution has proven to be successful in the UNECE region, in particular within the framework of the Convention on Long-Range Transboundary Air Pollution (CLRTAP) that has 51 Parties from a region with 56 countries. The Convention lays down the broad framework for international cooperation on air pollution control. Specific obligations for pollutants such as SO_X, NO_X, VOC etc. are stipulated in individual Protocols. Efforts need to be made to assist new Parties to implement the Convention and to make it possible for more countries to ratify and implement the Convention and its Protocols. Central Asia is an underdeveloped region in this respect. Kazakhstan and Kyrgyzstan ratified the Convention in 2001 and 2000 respectively, but neither has yet acceded to any of the Protocols.

Central Asia is an important area when considering long-range hemispheric transport of air pollution as the region is situated between Europe and East Asia. This is another reason why it is important to involve Central Asia in the work under the Convention. With this as a background a project “Capacity Building for Air Quality Management and the Application of Clean Coal Combustion Technologies in Central Asia” (CAPACT) has been set up. CAPACT is funded by the UN Development Account (680.000 USD) and is implemented by UNECE and partners in 2004–2007 (Figure 1).

The CAPACT project includes six major components:

1. The development of a National Programme for air quality management and for implementing selected LRTAP Convention Protocols of a pilot country. Kazakhstan has been selected as the pilot country and work is now underway to develop a separate chapter of the National Ecological Programme.

2. Raising awareness in Central Asia on air quality management and international cooperation on transboundary transport of air pollution and improved subregional cooperation on air quality management issues.

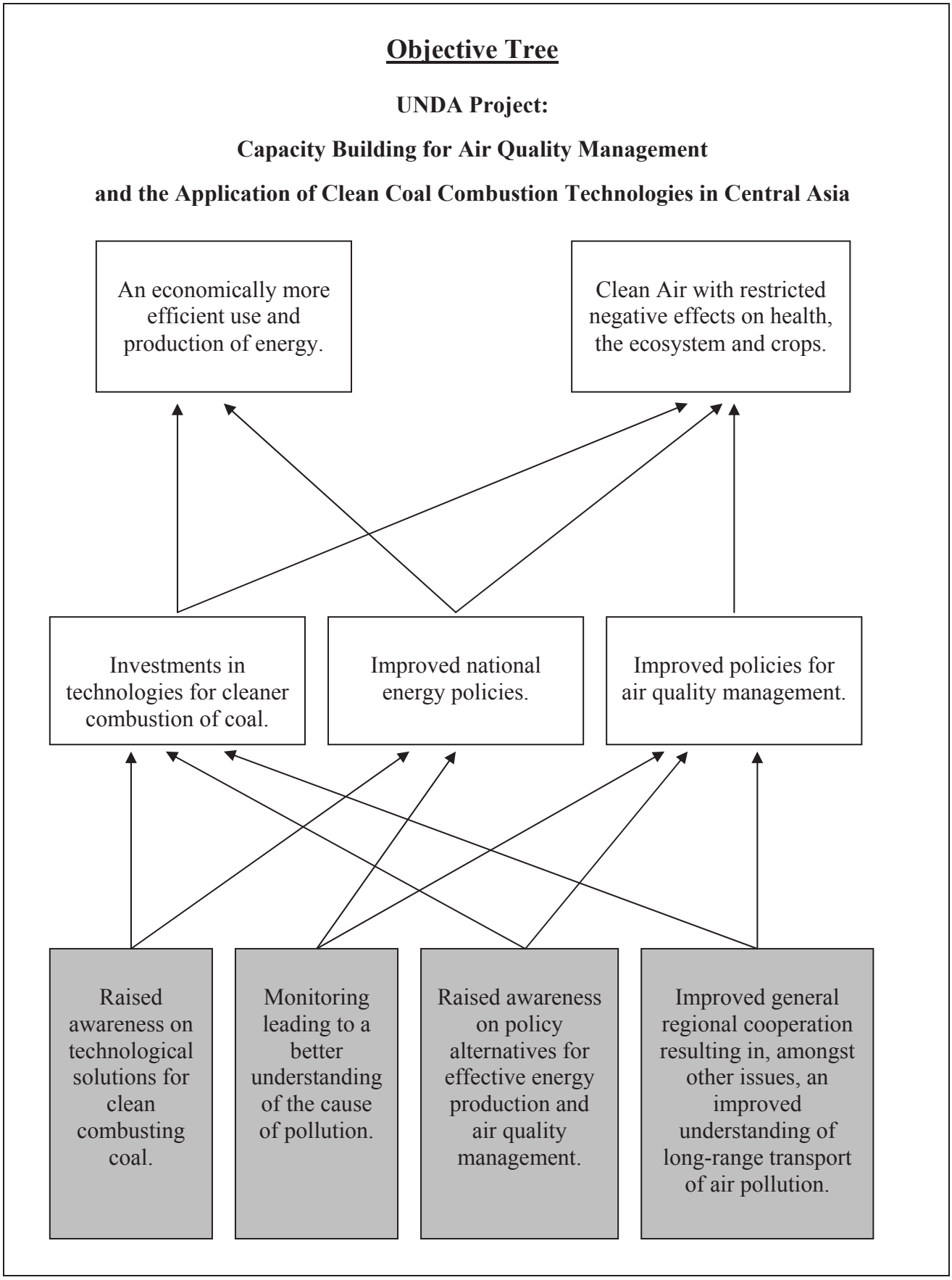

Figure 1: Objective Tree. Shaded boxes indicate the intervention level of the project.

3. Upgrading and testing one station of air pollution monitoring in Central Asia as a link between the EMEP and the Asian air-monitoring network. The establishment of the Borovoe EMEP station in Kazakhstan is underway and it will start delivering data in 2007.

4. Establishment of a sub-regional network comprising representative experts on clean coal technologies and investment project finance from the public and private sectors of interested participating countries in Central Asia.

5. Review of energy policy and energy pricing reforms relevant to the promotion of appropriate clean coal technology.

6. An enhanced capacity to identify and develop investment projects for the introduction of low cost, fast payback clean coal technologies for the heat and power generation sector.

Some of the preliminary conclusions from the project that is entering its final year are:

- In Central Asia environmental issues are not mainstreamed into the planning of other sectors such as energy and transport, which makes it more difficult to plan and achieve long-term and cost-efficient solutions. Much remains to be done in order to link the potential negative effects of an increased use of coal with the opportunities of clean coal combustion technologies.
- There is a great need for capacity building in the region with regard to air quality management and its scientific underpinnings such as emission inventories and monitoring as well as to health effects.
- Kazakhstan with its rapidly growing economy is ready to take on international obligations for example with regard to air quality monitoring.
- The advanced scientific and policy-network of the CLRTAP is important for the development of air quality management capacity not only in Central Asian but also other countries in Eastern Europe and Caucasus. The two Meteorological Synthesising Centres and the Chemical Coordination Centre operating under the Convention are essential in this respect.

The implementation of the project can be followed and its documentation found on the project website:
http://www.unece.org/ie/capact/.

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NOTES AND NEWS

WHO Challenges the World to Improve Air Quality

The World Health Organization (WHO) challenges governments around the world to improve air quality in their cities in order to protect people's health. WHO published its new Air Quality Guidelines with considerable lower concentration levels of pollutants in October 2006. WHO believes that reducing levels of one particular type of pollutant (known as PM_{10}) could reduce deaths in polluted cities by as much as 15% every year. The Guidelines also substantially lower the recommended limits of ozone and sulphur dioxide.

The WHO Air Quality Guidelines, first published in 1987, are designed to offer guidance in reducing the health impacts of air pollution. Based on a review of the accumulated science evidence, the revised guideline values provide an uniform basis for the development of strategies for the control of air pollution, and contribute to protect and improve public health from adverse effects of air pollutants across all WHO regions. This new global update for the first time addresses all regions of the world and provides uniform targets for air quality. These targets are far tougher than the national standards currently applied in many parts of the world - and in some cities would mean reducing current pollution levels by more than three-fold.

Further information can be obtained from: http://www.euro.who.int/air/activities/20050222_2.

Thermal comfort / Excess winter deaths

An abundant literature is aimed at establishing a causal link between exposure to cold temperature and mortality and specific morbidity. Vulnerable people are more likely to die during cold winter months, giving rise to the phenomenon of excess winter deaths (EWD). The phenomenon has been studied intensively in the UK, and some other countries have started to look into the effects of cold and extreme temperatures in general. Almost all available studies show that the elderly are at greatest risk. Data from the UK also demonstrate that EWD are related to poor housing conditions and fuel poverty.

Recent analysis suggests that the seasonal variations are related to indoor rather than outdoor temperature and that this annual variation could be reduced by helping residents to protect themselves from cold weather conditions. WHO is currently collecting data for various countries of the WHO European Region, focussing on the countries of Central and Eastern Europe (CEE) and the newly independent states (NIS). The objective is to review the seasonal aspects of mortality and estimate EWD in this Eastern part of the European Region of the World Health Organization (WHO).

Therefore WHO European Centre for Environment and Health have planned a technical meeting on housing, energy and thermal comfort in Bonn, Germany in autumn 2006. Scope and purpose will be the impact of climate and temperature on health which has been receiving increased attention in recent years, partially related to the global climate change and the number of extreme weather events. This is also the case for the impact of low temperatures, which can be reduced through adequate housing standards, heating systems and energy supply.

Although a precise assessment of the burden of disease caused by indoor thermal discomfort and fuel poverty is not yet available, low indoor temperatures may be of

great importance in many European countries. Considering climate as well as economic and housing conditions, it may be expected that the situation is especially serious in the Eastern part of the WHO European Region.

To discuss the potential policy options and current actions addressing this issue, WHO convenes this expert meeting. Its main objective is to develop a better knowledge of the current strategies to address the problem of low temperatures in selected member states of the WHO European Region.

The agenda foresees to:

- Present the evidence existing on the health impacts of low temperatures (in relation to housing conditions, to the extent possible).
- Review and discuss policy responses and countermeasures in selected countries.

A group of experts and national representatives will be convened by WHO in Bonn, Germany. The expert group will include scientists, policy-makers and practitioners. For further information, see: http://www.euro.who.int/Housing/Activities/20041013_3.

Preliminary overview of LARES findings

The WHO housing and health program has coordinated a large European housing and health survey, aiming at a comprehensive understanding of housing and health. The Large Analysis and Review European Housing and Health Status (LARES) survey has been undertaken in eight cities in different European countries in 2002 and 2003, and covered a variety of health-relevant housing problems. On the health side, the survey covered many relevant health outcomes such as self-reported health, depression, sleep disturbance, allergies, respiratory effects and asthma. The data set has recently been analyzed by an expert group focusing on various housing-health relationships. The overview document provides information on the first results and informs on the current housing and health challenges in the WHO European Region. For more information, see: http://www.euro.who.int/Document/HOH/LARES_results.pdf.

Continuous Measurements of Air Pollutants in Germany

Several times a day monitoring stations of the Federal Environmental Agency (UBA) and the networks of the sixteen German Laender are collecting data concerning the quality of ambient air.

From the website (http://www.env-it.de/luftdaten/start.fwd?setLanguage=en) the user can get up-to-date information for the following air pollutants: particulate matter (PM_{10}), carbon monoxide, ozone, sulphur dioxide and nitrogen dioxide. Data are available between 07:30-22:30 h as one-hour-averages of various pollutants which are updated hourly (every 3rd hour in winter time) and at 07:30 h as one-hour-averages of the past night and evaluations of the previous day. Additionally the data of the past 40 days are available. A daily ozone forecast will be provided during summer time.

Please note that all measured data represent preliminary values which are subject to change.

MEETINGS AND CONFERENCES

Healthy Buildings Conference, 4–8 June 2006 in Lisbon, Portugal

The Healthy Buildings Conference gathered over 700 leading scientists, representatives of governments, industry, and students to *Centro de Congressos* in the capital of Portugal. The conference organized every three years by the International Society of Indoor Air Quality and Climate (ISIAQ, www.isiaq.org) was chaired by professor Eduardo de Oliveira Fernandes from University of Porto.

The topics of the multidisciplinary conference covered indoor air quality and human responses (including health issues as the main aspect from WHO point of view), indoor climate (comfort, productivity, etc.), design and operation of buildings, materials, systems and technologies, as well as policy aspects of promoting healthy buildings, including IAQ standards and guidelines.

In midst of all these fields affecting the quality of our daily working and living conditions it is easy to require for a holistic view that would bring order to the multidisciplinary chaos. The cry for synthesis was answered by one of the most merited members the society, professor Ole Fanger from Denmark, in his keynote lecture by calling for replacing mediocrity in building design with targeting complete wellbeing, citing the WHO definition of health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO 1946).

ISIAQ was founded in 1992 and is currently facing a challenge of involving new generations in the important work. Both the keynote speaker, editor, Jan Sundell, as well as the new president of the society, Kwok Wai Tham invited the students that were well represented in the conference audience and presentations, to join the community and to continue the work of improving the indoor environments towards healthier and cosier ideals of complete wellbeing. Coming events in the field are:

- CLIMA 2007, Helsinki, 10-14 June 2007
- ROOMEVENT 2007, Helsinki, 13-15 June 2007
- IAQ 2007, Baltimore, 14-17 October 2007
- INDOOR AIR 2008, Copenhagen, 17-22 August 2008
- HEALTHY BUILDINGS 2009, Syracuse, New York.

For more details, see “Coming Events”.

The undersigned participated the conference on behalf of the WHO air quality programme to present and discuss the plan to develop WHO guidelines for indoor air quality. Almost forty prominent members of the scientific community and other relevant parties and representatives of the organising society and some others invested their time in discussing the format and scope of the planned activity.

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Air Pollution, Urban Transport and Health, 15 June 2006 in Rome, Italy

Over 8.000 annual deaths in Italian cities are attributable to long term effects of particulate matter air pollution and ozone. The study on Health impact of PM_{10} and ozone in Italian cities launched by WHO/Europe provides evidence that new proposed air quality limits are needed. Italy is in the spotlight of this new study. Thirteen Italian cities of over 200 000 inhabitants were subject of the study: Turin, Genoa, Milan, Trieste, Padua, Venice-Mestre, Verona, Bologna, Florence, Rome, Naples, Catania, Palermo, corresponding to about 9

millions or 16% of the total national population. The study estimates deaths and diseases due to particulate air pollution and ozone and identifies policies to ensure air of quality. Results from a case study carried out within HEARTS, a major European collaborative project on health effects of transport, were also presented.

Source:
WHO Environment and Health Newsletter No. 1, June 2006, website:
http://www.euro.who.int/envhealth/news/20060616_1 .

International Conference on Environmental Epidemiology & Exposure 2–6 September 2006 in Paris, France

The International Conference on Environmental Epidemiology & Exposure hosted ISEE's 18th and ISEA's 16th annual conference. ISEE (International Society for Environmental Epidemiology, http://www.iseepi.org) provides a forum for the discussion of issues comprising environmental quality, environmental pollution and the impacts on human health and supports the use of environmental epidemiology to inform policy. ISEA (International Society of Exposure Analysis, http://www.iseaweb.org) was created to foster and advance the science of exposure analysis related to environmental contaminants, both for human populations and ecosystems and works to strengthen the impact of exposure assessment in environmental policy.

The conference was organised by the French Agency for Environmental and Occupational Health Safety (Afsset) and took place two years after the launch of the European Commission's Environment and Health Action Plan and a few months prior to the mid-term assessment of the progress made by the 53 Member States of the WHO European Region since the 4th Ministerial Conference was held in Budapest, June 2004. The conference was attended by some 1400 scientists from 62 countries worldwide continents and comprised 1200 presentations including 800 Posters. Presentations at the different symposia, sessions, poster discussion rounds and poster presentations covered all exposure routes (inhalation, ingestion and dermal) as well as the environmental media and pathways leading from sources to human contact. They covered the whole spectrum of diseases that are shown or suspected to have environmental determinants and that may be revealed from birth (or fertility impairment) to late adulthood. The presentations were organized in eight parallel runs, thus this report cannot give an overall impression. All papers of the conference are available in a print version containing about 500 pages.

Each year both societies award prizes. The ISEE John Goldsmith Award for Outstanding Contributions to Environmental Epidemiology was handed over to Klea Katsouyanni (Greece). She is the coordinator of the APHEA (Air Pollution and Health: a European Approach) network, a EU funded project which was established in 1993 and produced results which have contributed to the understanding of the air pollution associated health effects in Europe and to the establishment of legislation for the management of air quality. The ISEA J. Wesolowski Award in Recognition of Outstanding Contributions to Knowledge and Practice of Human Exposure Assessment was handed over to Larry Needham (USA). He rendered outstanding services to the development of human biomonitoring. He is chief of the Organic Analytical Toxicology Branch in the US Centers for Disease Control and Prevention (CDC) in Atlanta, GA.

In addition to the awards plenary session, there were plenary lectures in which latest developments and perspectives of epidemiology and exposure assessment were addressed. In the plenary session "Early Ages Exposures to Environmental Hazards" Germaine M. Buck Louis from the National

Institute of Child Health & Development (NIH), Rockville, USA, pointed out that the peri-conception interval as the earliest critical window for human development is often overlooked. She presented a concept for a Longitudinal Investigation of Fertility in which the influence of PCB, PBDE, PFOS, PFOA, pesticides, metals and cotinine on fertility and children's health will be examined. The plenary session on "Environment and Genetics" provided promise for elucidating the mechanisms of exposure related disease risks allowing better detection of those at greatest risks of adverse outcomes of particular exposures, and affording opportunity to develop prevention strategies for such individuals (Daniele Fallin, School of Public Health, Baltimore, USA). It became quite clear that environmental epidemiology has to deal with genetics and *vice versa*. This was again pointed out in the final plenary meeting and panel discussion "Meeting the Challenges of Environmental Health".

The topic air pollution and health was discussed in a great number of sessions and posters. The symposium "Regional multi-city time-series studies of air pollution and health: progress and prospects" provided a good overview on this matter.
Hundreds of time-series of the health effects of short term exposure to air pollution have now been conducted worldwide. The „Air Pollution Epidemiology Database (APED)" of St. George's University London covers all 374 worldwide studies published in peer-reviewed literature. The objective of the evaluation of these data is to investigate some of the sources of heterogeneity in the effect estimates including spatially varying factors, analytical methods used, etc. (Atkinson et al.).

One of these studies is the European wide APHEA study (Katsouyanni et al.). APHEA was started in 1993. The current network (APHEA 2) consists of 22 research groups from 20 countries including 32 cities. For example, APHEA provided very useful data on PM_{10}. It was found that an increase of 10 $\mu g/m^3$ PM_{10} caused a significant increase of daily mortality rate of 0.5 %. The particle effects are larger in cities with higher NO_2-concentrations, in warmer climates and in cities with larger proportion of elderly.

A new approach is the APHENA study. The project brings together the APHEA 1 and 2 studies, the National Morbidity and Mortality Study (NMMAPS) in the United States, and national studies in Canada. The principal objective is again to characterize heterogeneity in the effects of particulate matter on mortality and morbidity across the included cities (Samet et al.). First results show that the effects of PM_{10} are comparable in Europe and North America. For ozone the estimates trend to be higher in the US compared with Europe, the highest in Canada. Another more recent international study is the "Public Health and Air Pollution in Asia" (PAPA)-Study in which China, Thailand and India are enrolled (Wong et al.). In Latin America and the Caribbean another study might be implemented focussing on cities in Brazil, Mexico und Chile (Romieu et al.).

All of the above mentioned studies deal with short-term effects thus it seems one of the most challenging tasks for epidemiological studies to reliably estimate subject's long-term exposure. The session "Air Pollution - Long-term Effects" provided information on new developments in this area of research. The objective of a Scottish study presented by Yap et al. was to investigate different methodologies to estimate long-term exposure to air pollution for subjects recruited in two large Scottish cohorts. The methodologies involved a combination of imputation and modelling techniques of both monitored data as well as local environmental predictors derived using Geographical Information System (GIS).

In the framework of ISEE/ISEA it was offered to the participants to visit "Pre-Conference Workshops" and "Early Training Courses" on selected topics. These sessions offered the possibility to look deeper into some interesting subjects. In the course "European Commission-sponsored research in

the field of environmental epidemiology“ Tuomo Karjalainen gave an overview of the EU-projects funded in the framework programmes FP 5 (1998-2002) and FP 6 (2002-2006). In these programmes 92 and 29 projects, respectively, have been funded focussing on a variety of environmental stressors like chemicals, air pollutants, electromagnetic fields, noise, climate change and their health relevance. FP 7 (2007-2013) will be announced in December 2006. Scheduled are topics like “environmental influences on reproduction and development”, “health impacts of indoor air quality”, “European network on human biomonitoring”, “European cohort on air pollution”, “health impact of drought and desertification”, “GIS applied to environmental epidemiology” and “ERA-NET for environment and health”. There have been some changes regarding implementation: budget has been increased, duration is seven years instead to four, and allocation shall be simplified. The most important improvement seems to be the IDEAS programme. Within this programme tendering institutions are no longer forced to look for collaborating partners in the EU.

The next ISEA meeting will take place in October 2007 in Durham/Research Triangle Park, NC, USA, and the next ISEE meeting in September 2007 in Mexico City.

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15th IUAPPA Regional Conference, 5–8 September 2006 in Paris and Lille, France

Compared to previous IUAPPA regional meetings the 15th regional conference has been concentrated on a more specific area under the theme ‘Air Pollution and Environmental Health – from Science to Action: the Challenge of Particulate Matter (PM)’.

The first day started with an afternoon symposium on ‘Risk Assessment Tools and Decisions – Making Progress for a Cleaner Air: the Example of Particulate Air Pollution‘ in conjunction with the International Congress of Epidemiology and Exposure Analysis in Paris. The symposium contained five contributions which were focussed on sources and composition of PM, to the assessment and integrated exposure, reflecting the globally updated WHO Air Quality Guidelines as well as the costs and benefits of limit value regulations, and communication strategies to meet policy makers’ information needs.
The main part of the conference took place from 6 to 8 September in Lille, the capital of the Region Nord-Pas de Calais. The aim of this meeting was to explore the prospects for a multi-disciplinary approach to health impact assessment of air pollution, particularly PM, and it’s potential contribution to an optimised policy building process. Issues related to PM were considered in the light of recent innovative research which raises challenging implications for future regulations.

The plenary session dealt with the relation between air pollution of PM, public health and prevention policies by introducing environmental health action plans, at international, national and regional levels. On the ‘Environment and Health’ way from Budapest 2004 to Rome 2009 WHO/Euro presented on the progress in policy implementation in Europe, in particular towards the Regional Priority Goal III on Air (ambient and indoor air) of the Children Environment and Health Action Plan (CEHAPE; http://www.who.dk/eehc). Country examples of developments within National Environmental Health Action Plans (NEHAP) were shown for Belgium (https://portal.health.fgov.be/portal/page?_pageid=78,1816570&_dad=portal&_schema=PORTAL), France (http://www.ecologie.gouv.fr/IMG/pdf/PNSE_interactif.pdf) and Germany (http://www.apug.de/), as well as for the

French regions Nord-Pas de Calais and Ile de France. With regard to the hosting region of northern France, many contributions reflected the situation, e.g. source identification and apportionment, stationary and road traffic sources, as well as regional differences in PM, in partly heavily industrially polluted neighbourhood areas of Nord-Pas de Calais and Flanders, such as the conurbation of Dunkerque, Roselare and Gent. In 2003 the PM_{10} annual average concentrations at industrial and suburban monitoring sites exceeded the limit value of 40 µg/m³. Highest PM_{10} concentrations were measured in the vicinity of industrial enterprises. An increasing trend with a daily limit value of 50 µg/m³ exceeded more than 35 times has been identified in this region, too. A model study of EMEP showed that Belgium, northern France, the Netherlands and the German Ruhr area is one of the PM hot spot regions in Europe.

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Meeting for the Development of WHO Guidelines for Indoor Air Quality 23–24 October 2006 in Bonn, Germany

The European Centre for Environment and Health of the World Health Organization convened a planning meeting for the development of indoor air quality guidelines. The meeting, funded by the German Federal Ministry for Environment, gathered 38 participants from five continents representing scientific expertise in health effects, exposures, developing country issues, indoor combustion of solid fuels, biological agents, building construction, ventilation and indoor air quality management as well as representatives of various WHO organizations and observers.

Indoor air quality plays a special role in relationship to health due to several reasons. Populations spend large fractions of their time in indoors and substantial fraction of their exposures to pollutants from outdoor air occurs in fact indoors. Moreover, the semi-closed nature of indoor spaces raises concentrations from any indoor sources to high levels and a number of pollutants significant in the indoor air do not exist in hazardous levels outdoors. Management of indoor air quality requires different approaches than ambient air. Due to all these reasons, the working group of the recently published Global Update of the WHO Guidelines for Air Quality (2006) recommended development of WHO guidelines for indoor air quality.
The planning meeting identified the main health hazards associated with indoor air quality problems world wide and recommended development of guidelines and guidance for

- specific pollutants existing in indoor environments,
- biological agents associated with health, and
- indoor combustion of solid fuels that is especially affecting large populations in developing countries.

The working group agreed that the development of the guidelines will require a substantial effort from the scientific community as well as WHO coordination. After the necessary fund-rising, the scientific work for the actual development of the guidelines should be planned for ca. 18 months, followed by process to publish the guidelines as an official WHO document in 2008/2009.

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PUBLICATIONS

WHO

Climate Change and Adaption Strategies for Human Health

B. Menne, K. Ebi, published on behalf of the World Health Organization Regional Office for Europe by Steinkopff Verlag, Darmstadt, Germany 2006, 449 pages, ISBN: 3-7985-1591-3, € 58.80, www.steinkopff.springer.de .

The book represents the results of the cCASHh study that was carried out in Europe (2001-2004), co-ordinated by WHO and supported by EU Programmes.

The flood events in 2002 and the heat wave of August 2003 in Europe had given evidence in a rather drastic way of our vulnerability and our non preparedness. The project has produced very important results that show that the concurrent work of different disciplines in addressing public health issues can produce innovative and useful results, providing an approach that can be followed on other public health issues. The project has shown that information on potential threats can be extremely useful in preparing the public for adverse events as well as facilitating the response when the events occur.

This is a new dimension for public health which reverses the traditional thinking: from identifying and reducing specific risk factors, to taking action on the basis of prediction and early warning to prevent health consequences in large populations.

Framework Plan for the Development of Monitoring of Particulate Matter in EECCA

R. Baumann, M. Krzyzanowski, S. Chicherin, WHO European Centre for Environment and Health, Bonn, Germany, WHO Europe Publications, Copenhagen, Denmark 2006, 40 pages, Document EUR/05/5046022, also available through the web: http://www.euro.who.int/document/e88565.pdf .

Monitoring and assessment of population exposure to particulate matter ($PM_{2.5}$ and PM_{10}) is a prerequisite of an effective health-related air quality management. To facilitate development of this monitoring in the Member States, and in particular in the countries of Eastern Europe, Caucasus and Central Asia (EECCA), this technical paper summarizes principles of PM monitoring and presents practical guidelines on essential steps to be taken in a country initiating PM monitoring. The cost-effectiveness of the system and its operation in countries with limited financial resources and limited expertise are assumed when the recommendations are formulated.

Reducing the health risks for children from ozone layer depletion – The new Ozone Education Pack Targets Primary Schools

The OzonAction Education Pack launched globally contains an entire teaching and learning programme, based on basic knowledge, practical skills and participation, to enable children to learn about simple solutions to protect the ozone layer and safely enjoy the sun. The pack, produced jointly by the United Nations Environment Programme (UNEP), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Health Organization (WHO), has been released to co-incide with the International Day for the Preservation of the Ozone Layer on 16th of September. This year's theme is "Protect the Ozone Layer, Save Life on Earth". Information about the Programme, including electronic copies of the OzonAction Education Pack, can be downloaded from: http://www.unep.fr/ozonaction/events/ozoneday/2006.htm .

Inventory of Air Quality and Health Authorities and Institutions in the WHO European Region

B. Brackmann, H.-G. Mücke, WHO Collaborating Centre for Air Quality Management and Air Pollution Control, Berlin, ISSN 0938-9822, Germany 2006.

Who is competent in the field of air quality and public health in Europe? A new guide issued by the Federal Environment Agency (UBA) has the answers. The 76-page document lists the most essential contacts and addresses of the national competent authorities as well as research and other institutions active in the field throughout Europe. Whether in Albania or Uzbekistan, making contact with the appropriate organizations no longer requires tedious research.

The 76-page WHO Air Hygiene Report No. 16, Inventory of Air Quality and Health Authorities and Institutions in the WHO European Region, is available free of charge from the Federal Environment Agency and may also be downloaded from the Internet at http://www.umweltbundesamt.de/whocc/titel/titel21.htm.

Preventing Harmful Health Effects of Heat-Waves

WHO Regional Office for Europe, Copenhagen, Denmark 2006, 10 pages, Document EUR/05/5067942, also available through the web: http://www.euro.who.int/Document/Gch/Harm_Heatwaves.pdf.

OTHERS

Clearing the Air

J. Sliggers, W. Kakebeeke, UNECE, Geneva, Switzerland 2004, 167 Pages, ISBN 92-1-116910-0, UN Sales No.: E.04.II.E.20, US $ 30.-.

The publication of this book marks the 25th anniversary of the UNECE Convention on Long-range Transboundary Air Pollution, one of the oldest and more successful multilateral international treaties protecting the environment. It shows the Convention as seen through the eyes of experts, delegates, chairmen and members of the secretariat with contributions from many of the leading players in the Convention's work over the years.

CompAir: Field Inter-Comparison of Air Quality Measurements between The Netherlands and North Rhine-Westphalia (Germany), Materialien 71

D. de Jonge et al., North Rhine-Westphalia State Environment Agency, Essen, Germany 2006, 28 pages, ISSN 0947-5206, available through the web: http://www.lua.nrw.de/veroeffentlichungen/materialien/mat71/mat71start.htm.

This issue reports on Simultaneous Measurements of Ambient Air Levels of Air Pollution by the North Rhine-Westphalia State Environment Agency (LUA NRW, Germany) and the National Institute for Public Health and the Environment (RIVM, Netherlands) Dutch-German Working Group carried out to enforce the Information Exchange on Implementation of European Air Quality Directives.

15th Annual Report 2006: UNECE Convention on Long-range Transboundary Air Pollution

S. Kleemola, M. Forsius, Finnish Environment Institute, Helsinki 2006, 88 pages, ISBN 952-11-2256-0, available through the web: http://www.ymparisto.fi/download.asp?contentid=55297&lan=en.

The Integrated Monitoring Programme (ICP IM) is part of the effect-oriented activities under the 1979 Convention on Long-range Transboundary Air Pollution, which covers the region of the United Nations Economic Commission for Europe (UNECE). The main aim of ICP IM is to provide a framework to observe and understand the complex changes occurring in natural/semi natural ecosystems.

This report summarizes the work carried out by the ICP IM Programme Centre and several collaborating institutes.

Environmental Health in Central and Eastern Europe

K.C. Donelly, L.H. Cizmas, Dordrecht, Springer 2006, 249 pages, ISBN 1-4020-4844-0, € 96.25, http://www.springer.com.

Complex chemical mixtures impact our health every day. In the United States, and also in Central and Eastern Europe, there are a number of locations where complex chemical mixtures have been released to environmental media. Although exposure to mixtures is common, minimal information exists to quantify these exposures, or to determine their impact on human or ecological receptors. These proceedings present some of the most current research conducted to quantify complex mixtures in the environment and investigate their potential impact on human health. Many of the manuscripts reported in these proceedings represent the most up-to-date measurements of population exposures in Central and Eastern Europe. These studies are of value to health and environmental professionals around the world as they develop strategies for assessing exposures, remediating contaminated environments, and improving public health.

Technical Report No 3/2006: Air Pollution by Ozone in Europe in Summer 2005

EEA, Copenhagen 2006, 28 pages, ISBN 92-9167-813-9, available through the web: http://reports.eea.europa.eu/technical_report_2006_3/en.

Technical Report No 4/2006: Air Quality and Ancillary Benefits of Climate Change Policies

EEA, Copenhagen 2006, 58 pages, ISBN 92–9167–843-0, available through the web: http://reports.eea.europa.eu/technical_report_2006_4/en.

Technical Report No 8/2006: Annual European Community LRTAP Convention Emission Inventory 1990-2004

EEA, Copenhagen 2006, 58 pages, ISBN 92–9167–883-x, available through the web: http://reports.eea.europa.eu/technical_report_2006_8/en.

EEA Report No 9/2006 Greenhouse Gas Emission Trends and Projections in Europe 2006

EEA, Copenhagen 2006, 66 pages, ISBN: 92-9167-885-6, Catalogue No: TH-AL-06-007-EN-C, € 15.-, also available through the web: http://reports.eea.europa.eu/eea_report_2006_9/en.

COMING EVENTS

2007

March 2007

International Conference on Transport and Environment: A Global Challenge
Follow-up of the EURO-V Conference 2003, Milan. 19-21 March, Milan, Italy.

Sixth International Conference on Urban Air Quality
27-29 March, Limassol, Cyprus.
For more information, see: www.urbanairquality.org .

April 2007

DustConf 2007:
How to Improve Air Quality
23-24 April, Maastricht, The Netherlands.
For more information, see: www.dustconf.com .

Air Pollution 2007
23-25 April, Algarve, Portugal.
For more information, see: www.wessex.ac.uk .

Sustainable Development 2007
25-27 April, Algarve, Portugal.
For more information, see:
http://www.wessex.ac.uk/conferences/2007/sustain07/index.html .

May 2007

Better Work 2007 -
International Conference on Healthy Air
29–31 May, Helsinki, Finland.
For more information, see:
http://www.ttl.fi/workair2007 .

June 2007

Well-Being Indoors -
Nineth CLIMA World Congress 2007
10-14 June, Helsinki, Finland.
For more information, see:
http://www.clima2007.org .

Roomvent 2007
13-15 June, Helsinki, Finland.
For more information, see:
www.roomvent2007.org .

Environmental Health Risk 2007 – Fourth International Conference on the Impact of Environmental Factors on Health
27-29 June, Malta. For more information, see: http://www.wessex.ac.uk/conferences/2007/health2007/1.html .

September 2007

Urban Transport 2007 – 13th International Conference on Urban Transport and the Environment in the 21st Century
3-5 September, Coimbra, Portugal. For more information, see:
www.wessex.ac.uk/conferences/2007/urban2007/1.html .

19th Conference of the International Society for Environmental Epidemiology (ISEE)
5-9 September, Mexico City, Mexico.
For more information, see: www.isee2007mx.org .

14th World Clean Air and Environmental Protection Congress (IUAPPA)
9-13 September, Brisbane, Australia. For more information, see: www.icms.com.au/iuappa2007.

October 2007

ASHRAE's IAQ 2007 Conference – Healthy and Sustainable Buildings
15-17 October, Baltimore, Maryland, USA.
For more information, see: www.iaq2007.org .

IAQVEC 2007 - Sixth Int. Conference on Indoor Air Quality, Ventilation and Energy Conservation in Buildings
28-31 October, Sendai, Japan. For more information, see: www.archi.tohoku.ac.jp/labs-pages/kankyo/IAQVEC/IAQVEC_e.html.

2008

August 2008

Indoor Air 2008
17-22 August, Copenhagen, Denmark.
For more information, see: www.idoorair2008.org .

EDITORS' NOTE

We appreciate submissions to NOTES AND NEWS regarding programmes and projects within the field. Notes (100-500 words) should be sent directly to the WHO Collaborating Centre for Air Quality Management and Air Pollution Control.

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