17th meeting of the Joint Convention/WHO Task Force on Health Aspects of Long-range Transboundary Air Pollution, Bonn, 14-15 May 2014

AIR POLLUTION HEALTH RISK ASSESSMENT (HRA):

POLICY CONTEXT

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Policy framework and practice of air pollution HRA in selected countries

Party of the CLRTAP	Formal requirement for HRA	HRA conducted in practice	HRA overview available
Albania	N	N	N
Armenia	Y (2014)	N	N
Austria	N	Y	N
Azerbaijan	N	N	N
Bosnia & Hercegovina	Y	Y **	N
Canada	Y	Y	Y
Croatia	N	Y **	N
EC	Y	Y	N
FYROM	Y	Y **	Y
Germany	N	Y	Y
Ireland	N	Y	N
Kyrgyzstan	N*	Y **	N
Moldova	Y (Dec 2013)	N	N
Norway	N	Y	N
Poland	N	Y	N
Serbia	Y***	N	N
Sweden	N	Y	N
Switzerland	Y	Y	Y
Turkey	N	N	N
Ukraine	Y	Y	N
UK	Y	Y	Y
USA	Y	Y	Y

* Response indicates that the air quality assessment is required, but not the health risk assessment
** Methods do not correspond to WHO methodology
*** MoH expects the HRA to be performed by the state PH network but this is not reflected in legal acts.

Purposes of HRA stated in legislation

- The assessment of benefits and costs (including health) of proposed programs, projects, regulations and policies.
- Evaluation the effectiveness of already introduced policies in respect to their objectives.
- A part of the Environmental Impact Assessment (EIA) procedure.
- Part of Public Health legislation (scope of HRA usually not specified).
- Part of a broader regulatory analysis.

Regulatory Analysis – definition by US OMB

Regulatory analysis is a tool regulatory agencies use to anticipate and evaluate the likely consequences of rules. It provides a formal way of organizing the evidence on the key effects, good and bad, of the various alternatives that should be considered in developing regulations. The motivation is to:

(a) learn if the benefits of an action are likely to justify the costs or

(b) discover which of various possible alternatives would be the most cost-effective.

***… Since agencies often design health and safety regulation to reduce risks to life, evaluation of these benefits can be the key part of the analysis*.**

US Office of Management and Budget, 2013

Questions addressed by HIA of air pollution

1. What is the public health burden associated with recent levels of air pollution?
2. What are the human health benefits associated with changing air quality policy or attaining a more stringent AQ standard?
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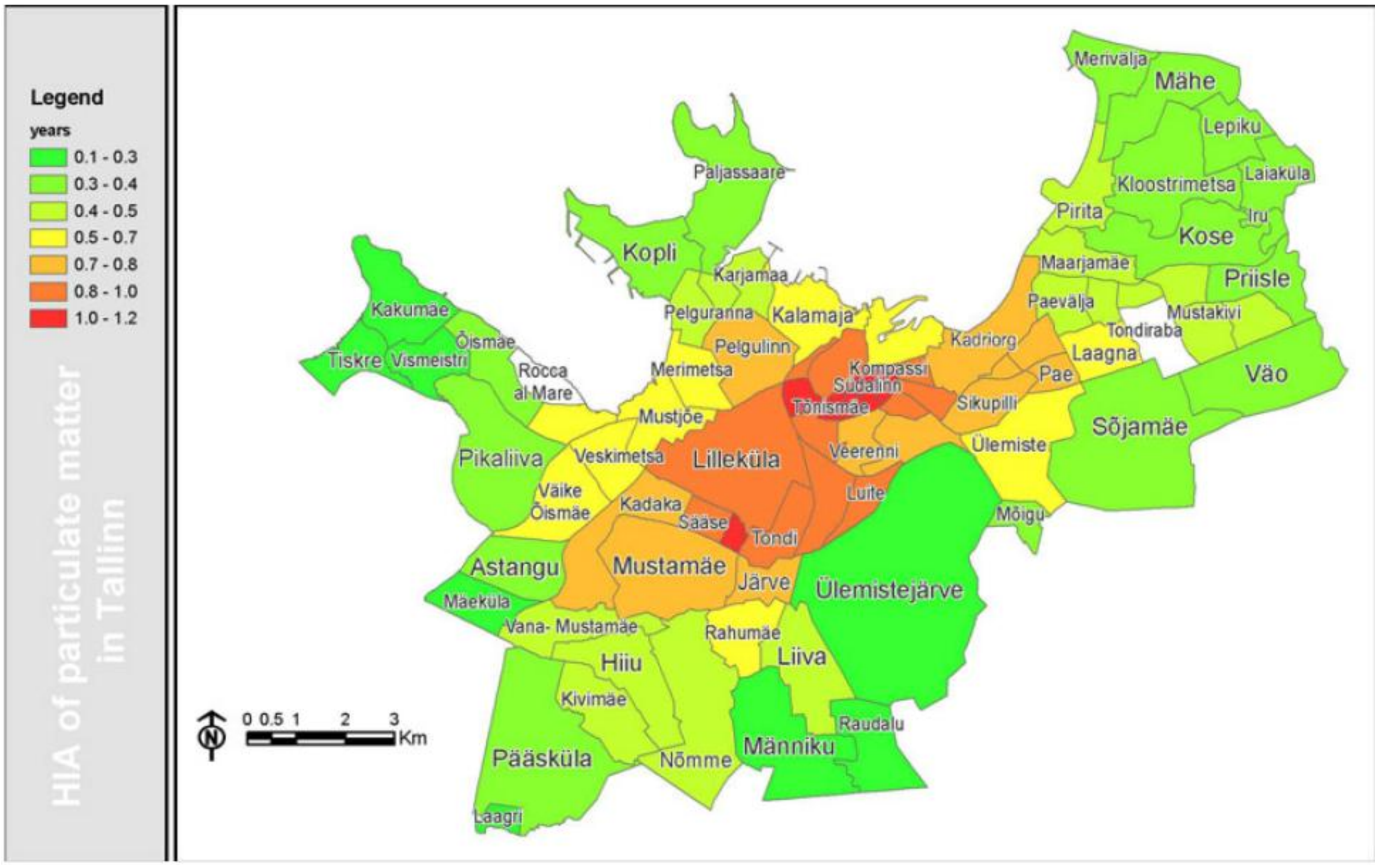
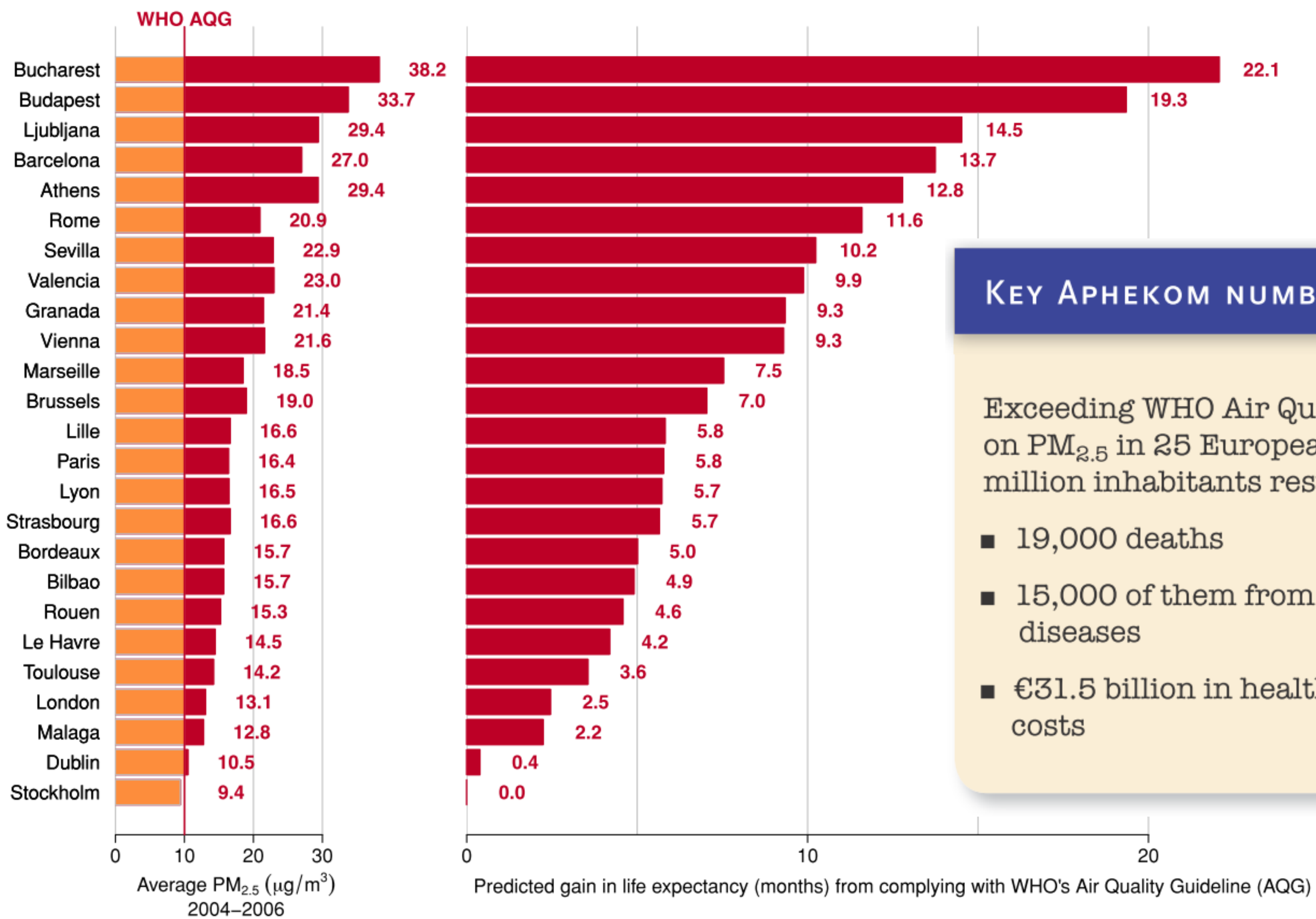
Decrease in life expectancy due to locally emitted $PM_{2.5}$ pollution in Tallinn, Estonia – effects of LOCAL pollution



Orru et al, Env Health 2009

The APHEKOM results:

Expected gain in life expectancy (months) for a decrease in average annual level of $PM_{2.5}$ to 10 µg/m³ (WHO AQG) – comparison between cities



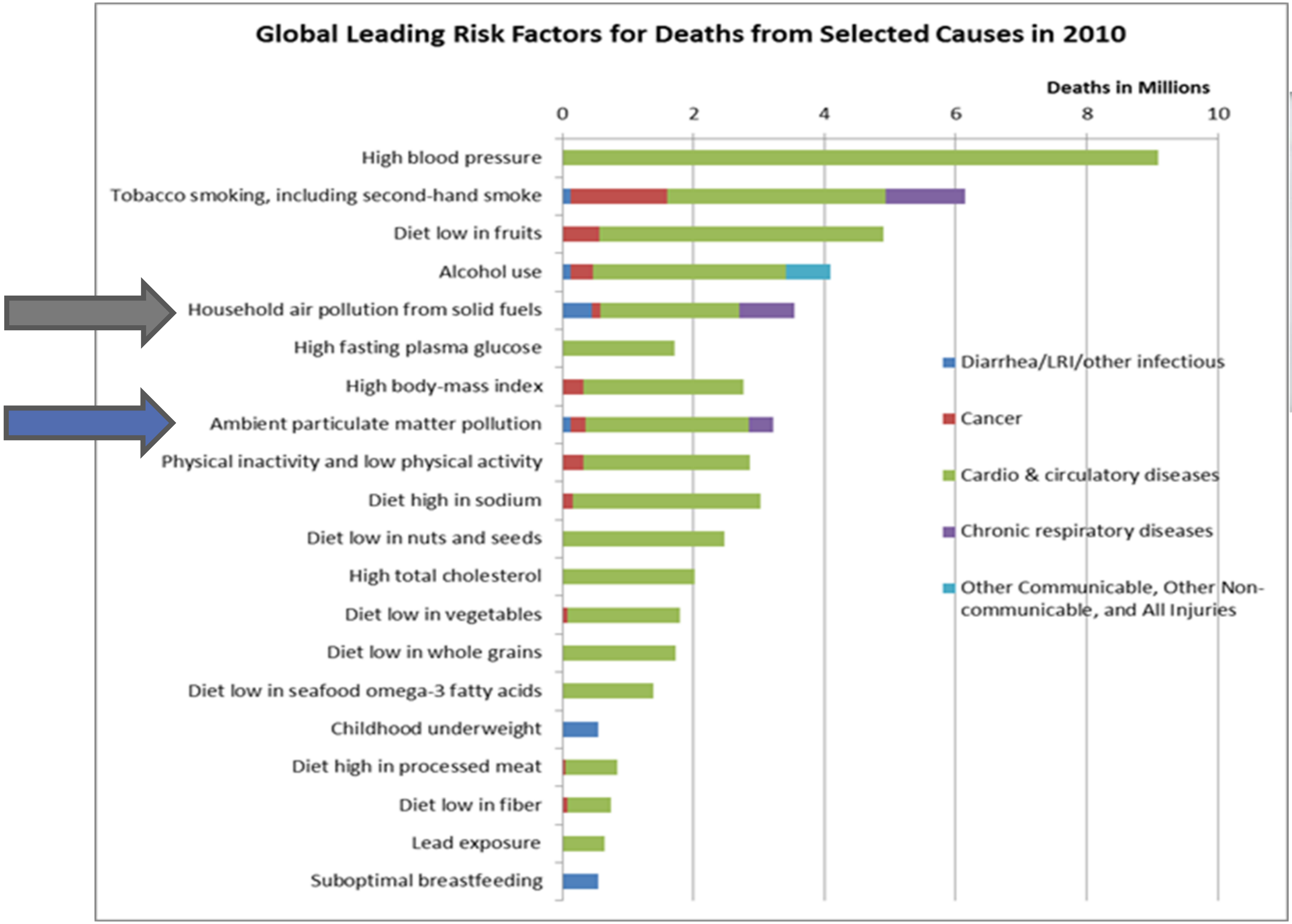
KEY APHEKOM NUMBERS

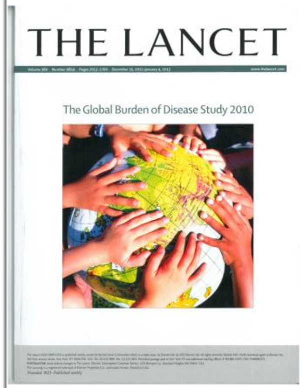
Exceeding WHO Air Quality Guidelines on $PM_{2.5}$ in 25 European cities with 39 million inhabitants results annually in:

- 19,000 deaths
- 15,000 of them from cardiovascular diseases
- €31.5 billion in health and related costs

HRA policy context

Global Burden of Disease 2010 – comparison with other risk factors





Lim et al 2012

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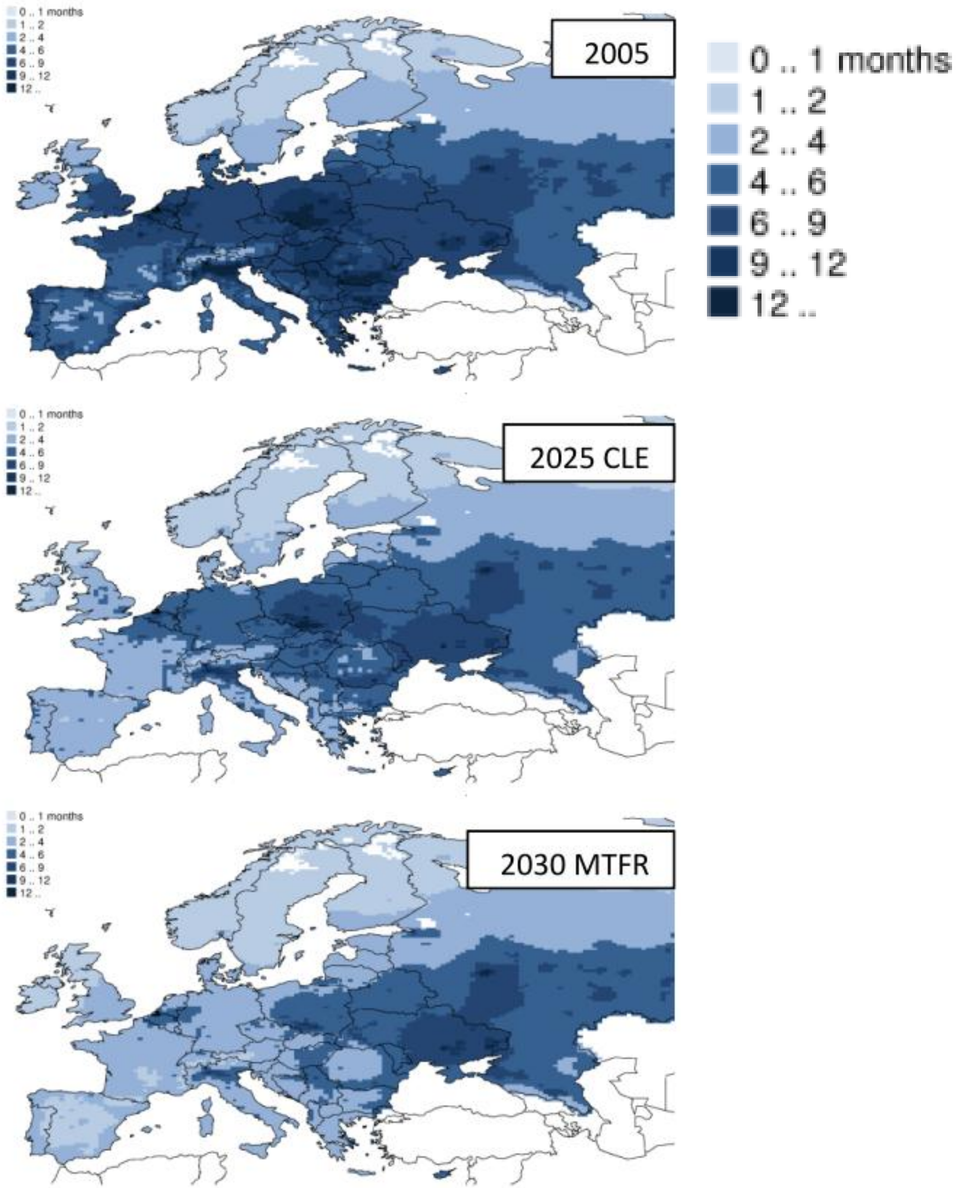
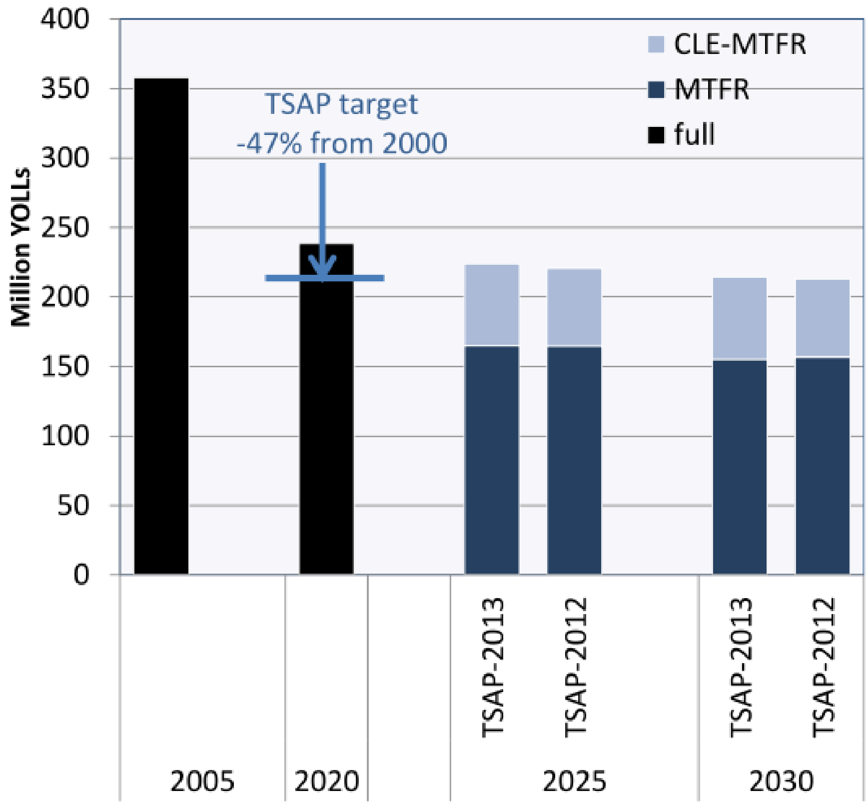
LOSS IN STATISTICAL LIFE EXPECTANCY (MAPS) AND YEARS OF LIFE LOST (YLL) DUE TO EXPOSURE TO $PM_{2.5}$ FROM ANTHROPOGENIC SOURCES IN EU





IIASA 2013

ESTIMATED NUMBER OF AVOIDED $PM_{2.5}$ HEALTH IMPACTS FOR NATIONAL AAQ STANDARD ALTERNATIVES

Health Effect	Alternative Annual Standards		
	13 µg/m³	12 µg/m³	11 µg/m³
Adult Mortality			
Krewski et al. (2009) (adult)	140	460	1,500
Lepeule et al. (2012) (adult)	330	1,000	3,300
Woodruff et al. (1997) (infant)	0	1	4
Non-Fatal Heart Attacks (age >18)			
Peters et al. (2001)	160	480	1,600
Pooled estimate of 4 studies	17	52	170
Hospital admissions—respiratory (all ages)	31	110	380
Hospital admissions—cardiovascular (age > 18)	43	140	480
Emergency department visits for asthma (all ages)	67	230	810
Acute bronchitis (age 8–12)	280	870	2,700
Lower respiratory symptoms (age 7–14)	3,500	11,000	34,000
Upper respiratory symptoms (asthmatics age 9–11)	5,100	16,000	49,000
Asthma exacerbation (age 6–18)	13,000	40,000	120,000
Lost work days (age 18–65)	22,000	71,000	230,000
Minor restricted-activity days (age 18–65)	130,000	420,000	1,300,000

Regulatory Impact Analysis for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter

USEPA 2012

COST-BENEFIT ANALYSIS FOR NEW AQ STANDARD ALTERNATIVES

Table ES-3. Benefit-to-Cost Ratios for Alternative Standards at 3% and 7% Based on Projected Benefits and Costs in 2020

	13 µg/m^3	12 µg/m^3	11 µg/m^3
Benefit-Cost Ratio 3%[a]	13 to 272	12 to 171	8 to 90
Benefit-Cost Ratio 7%	11 to 246	11 to 154	7 to 81

[a] Due to data limitations, we were unable to discount compliance costs for all sectors at 3%. See Chapter 7, Section 7.2.2 for additional details on the data limitations. As a result, the net benefit calculations at 3% were computed by subtracting the costs at 7% from the monetized benefits at 3%.

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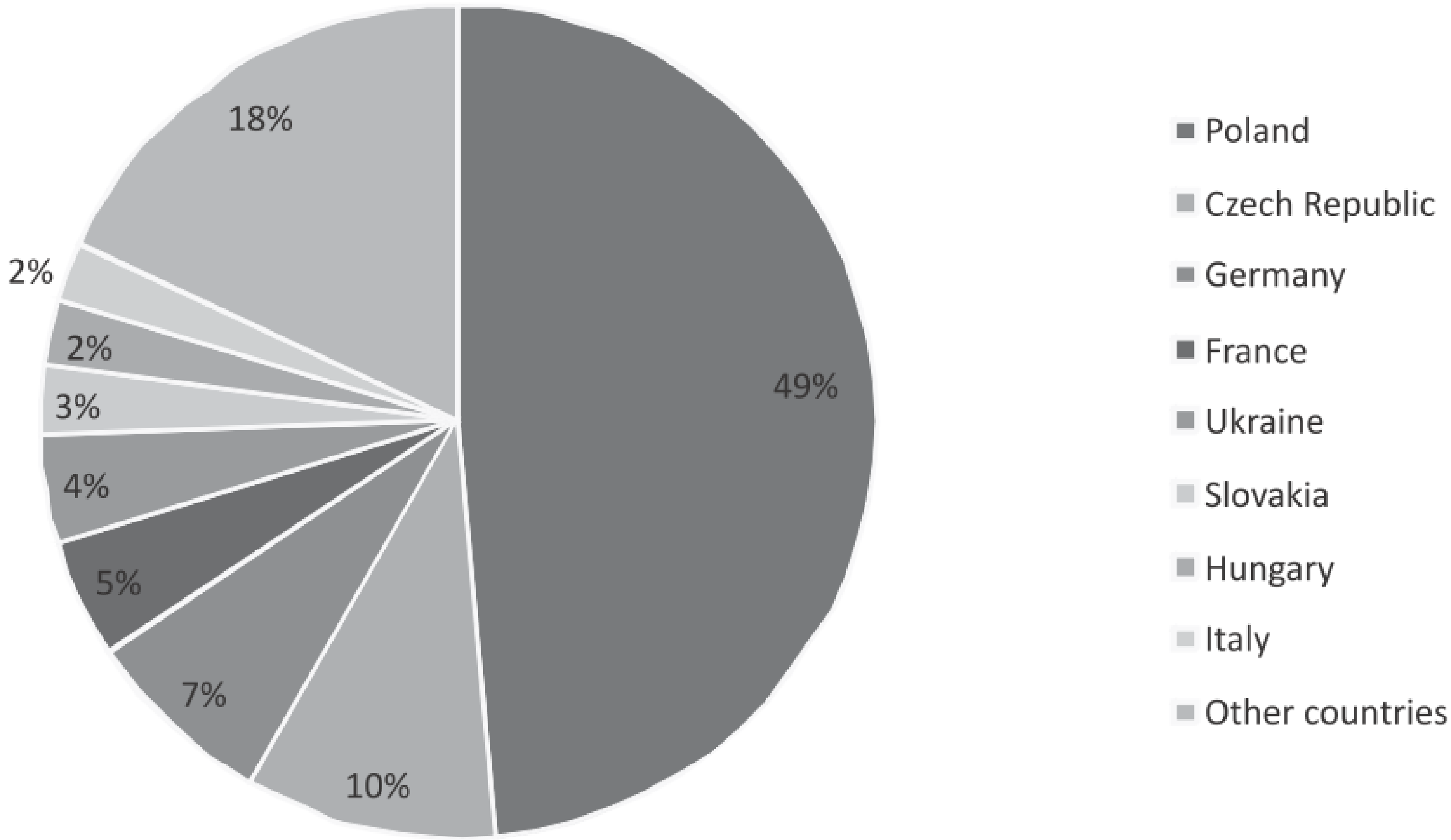
Estimated current health damage due to PM and benefits and costs from air pollution abatement options in Ulaanbaatar

	Annual number of cases		Monetized (mill USD)			
	All-cause mortality (chronic)	Chronic bronchitis / Hospital admissions (Respiratory disease) / Hospital admissions (CVD)	All-cause mortality (chronic)	Chronic bronchitis / Hospital admissions (Respiratory disease) / Hospital admissions (CVD)	SUM (mill USD)	**Share of GDP in UB (2008)**
Current health damage	**1591 (385 - 2721)***	**1411 / 4465 / 4063 (1219 - 1516)* / (1828 - 8083)* / (2290 - 6122)***	**352 (85 - 601)***	**100 / 4.71 / 6.92 (86 - 107)* / (1.9 – 8.5)* / (3.9 – 10.4)***	**463 (177 – 727)***	**18.8 % (7.2 – 29.5)***
30% reduction of Ger stoves	63	74 / 619 / 528	14	5 / 0.65 / 0.90	21	**0.8 %**
80% reduction of Ger stoves	198	253 / 1663 / 1444	44	18 / 1.75 / 2.46	66	**2.7 %**
30% reduction of HOBs	3	3 / 28 / 24	1	0 / 0.03 / 0.04	1	**0.0 %**
80% reduction of HOBs	7	8 / 75 /64	2	1 / 0.08 / 0.11	2	**0.1 %**
30% reduction of suspended dust	53	60 / 520 / 443	12	4 / 0.55 / 0.75	17	**0.7 %**
80% reduction of suspended dust	159	199 / 1395 / 1205	35	14 / 1.47 / 2.05	53	**2.1 %**
30% reduction of all 3 sectors	129	159 / 1172 / 1009	29	11 / 1.24 / 1.72	43	**1.7 %**
80% reduction of all 3 sectors	**522**	**707 / 3169 /2822**	**115**	**50 / 3.34 / 4.81**	**174**	**7.0 %**

HOB – Heat only boiler

The World Bank 2011

Contribution of anthropogenic emissions in various countries to premature mortality due to PM exposure in Poland



Taino et al, 2010

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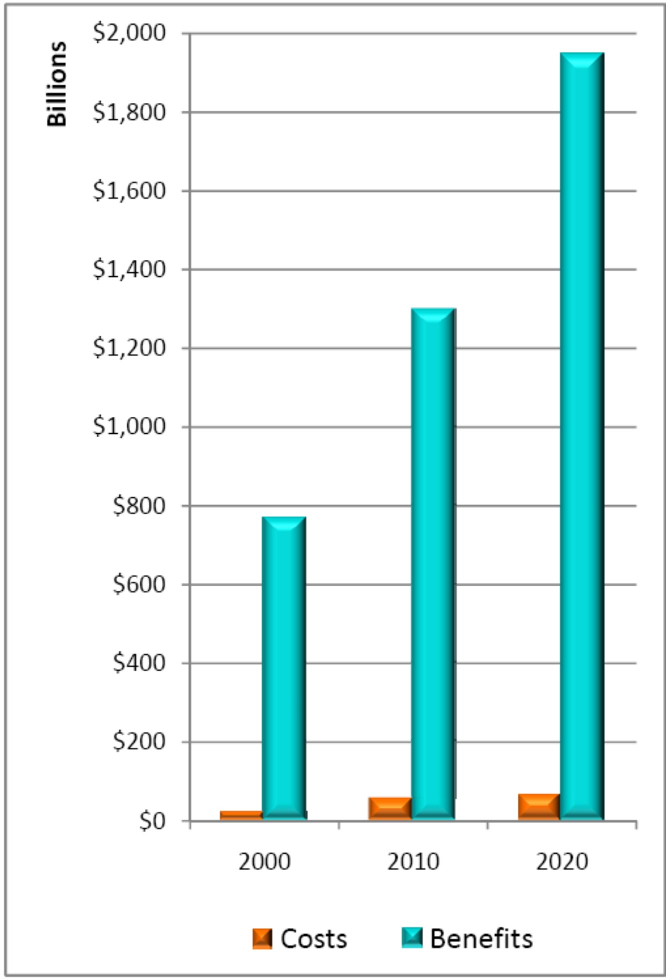
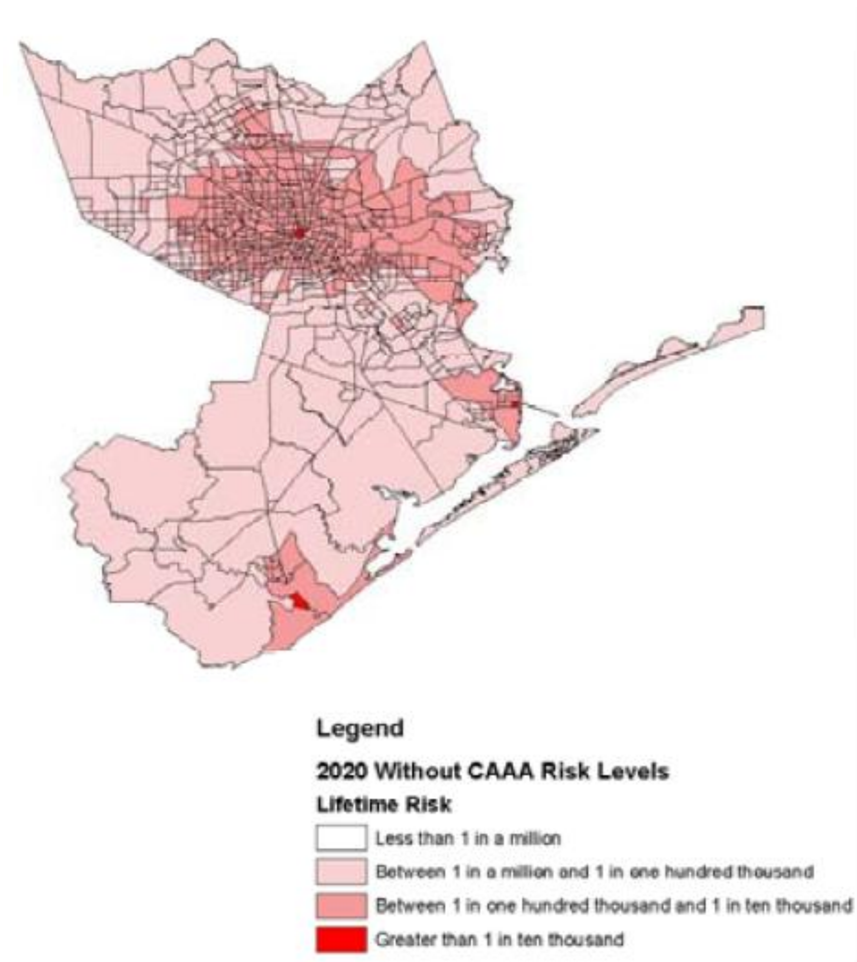
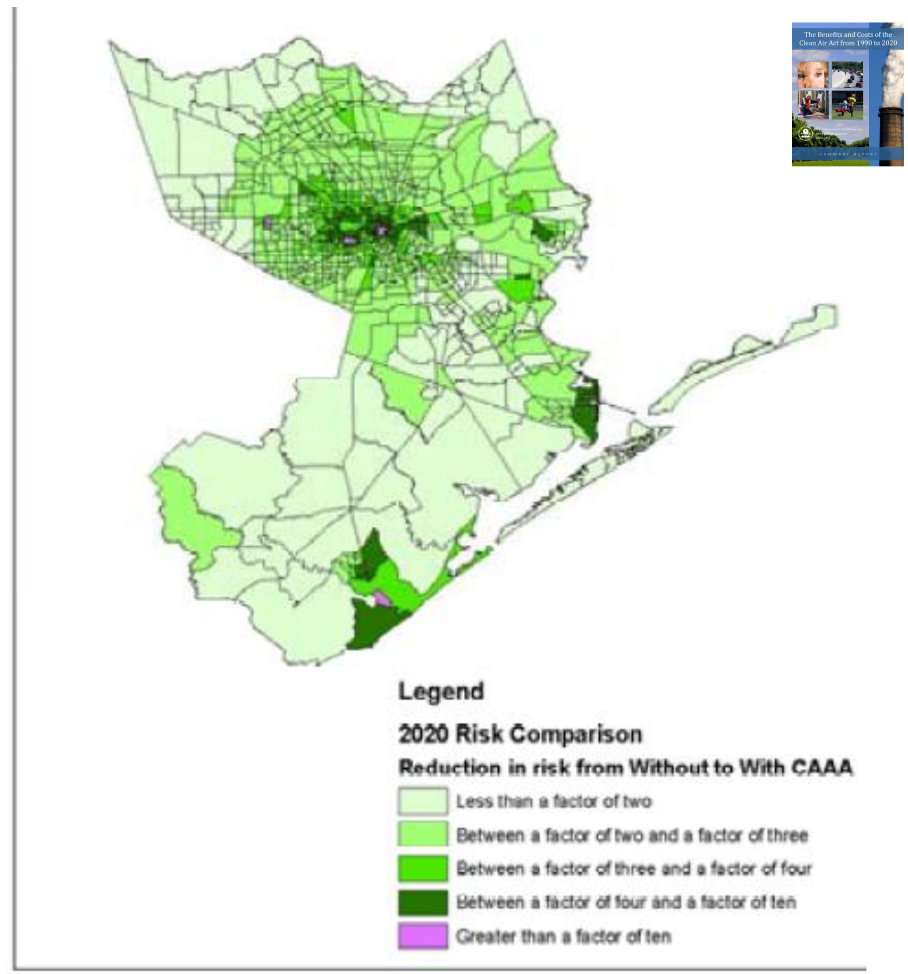
Benefits and costs of the Clean Air Act of the USA



Source: US EPA 2011

Effect of the Clean Air Act on lifetime risks of benzene-related leukaemia in the Houston area





Source: US EPA 2011

Expected* and observed (Real) mortality reductions associated with the observed decrease in pollutant levels in intervention studies

Study	City/area	Assessed pollutant	All-cause		Respiratory		Cardiovascular	
			Real (%)	Expected (%)	Real (%)	Expected (%)	Real (%)	Expected (%)
Clancy et al. (2002)	Dublin	BS	−5.7	−2.1	−15.9	−2.8	−10.3	−1.4
Rich et al. Abstract, 2009	Cork	BS	−7	−1	−8	−1.3	−13	−0.7
Pope et al. (1992)	Utah Valley (Steel mill)	PM_{10}	−3.2	−0.6	−4.3	−0.7	−2	−0.7
Pope et al. (2007)	Utah Valley (Copper smelter)	SO_2	−2.5	−0.2	n.a.	n.a.	n.a.	n.a.
Hedley et al. (2002)	Hong Kong	SO_2	−2.1	−1.4	−3.9	−2.3	−2	−1.9

* The expected mortality reductions are calculated using the observed decrease in pollutant levels (µg/m^3) from the reviewed interventions and the effect estimates of Katsouyanni et al. (1997) and for cardio-respiratory deaths and PM_{10} of Samoli et al. (2005)

Henschel et al 2012

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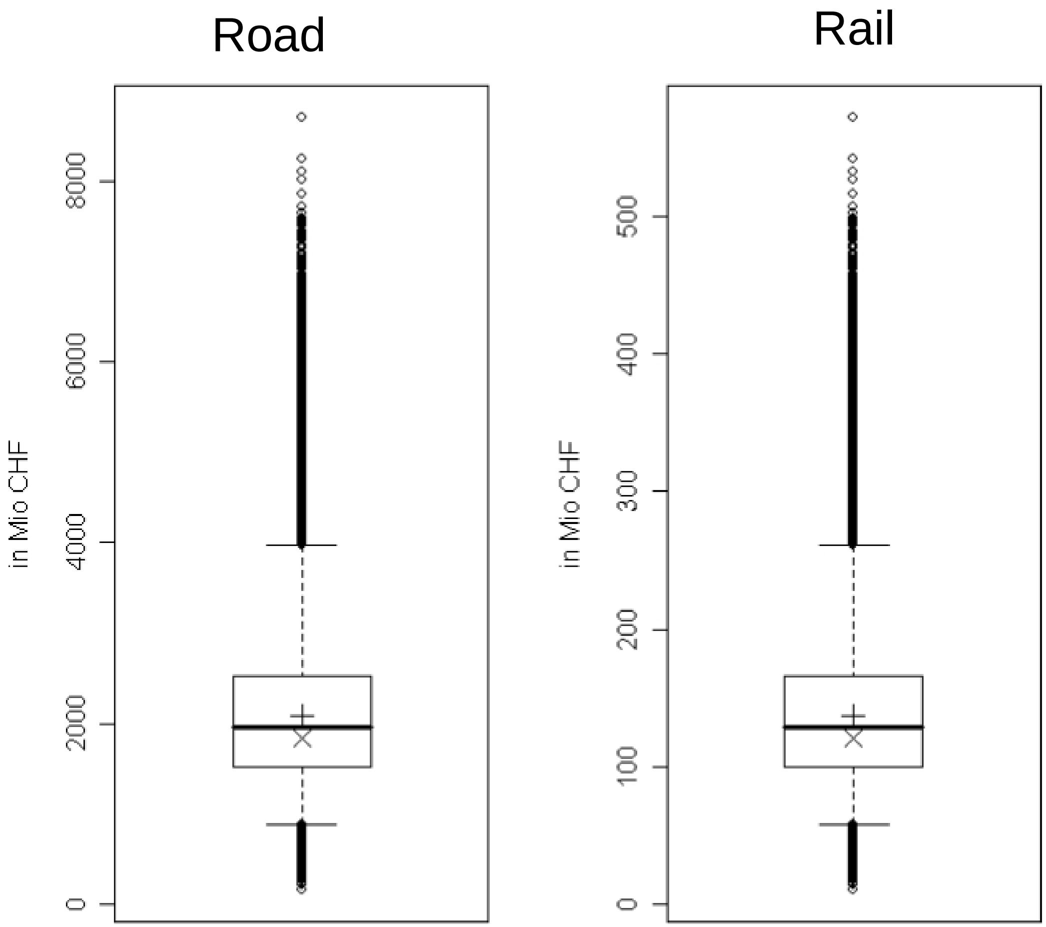
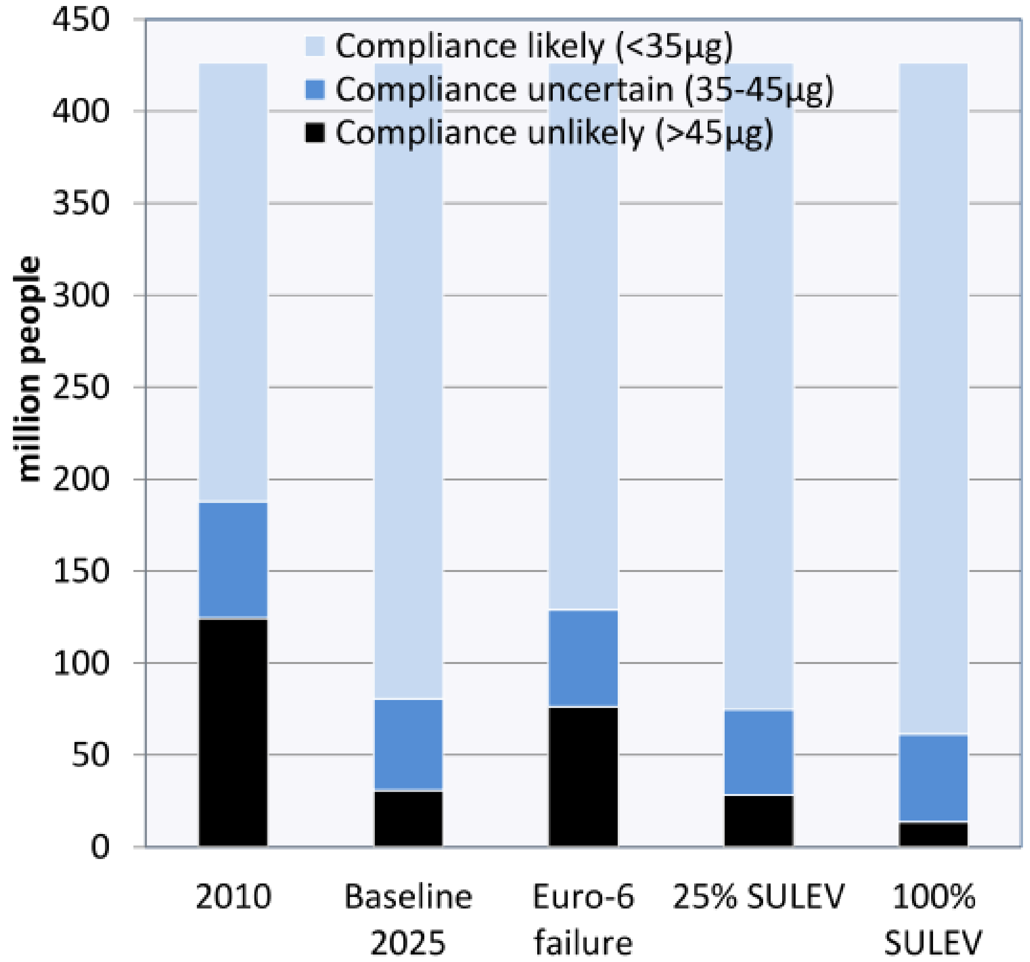
Costs of health effects of air pollution due to road and rail transport in Switzerland: Monte Carlo simulation of uncertainty



Bundesamt für Raumentwicklung ARE, Bundesamt für Umwelt BAFU 2008

EU population living in areas with various probability of NO_2 LV (40 µg/m^3) compliance under various policy scenarios



SULEV: super ultra low emission vehicles

Amann et al, 2013

Conclusions

- **Formal requirements for HRA – varying between countries.**

- **Questions to HRA include quantification of health effects of the past, present and future emissions.**

- **Full scenario analysis requires use of a series of models linking emission from specific sources with health effects.**

- **Good support to policies in countries with well defined institutional arrangements and capacities for HRA.**