



11th ETH Conference on Combustion Generated Nanoparticles

Combustion Particles and Preventive Measures against Cancer Zürich ETH Zentrum, 13.8.2007

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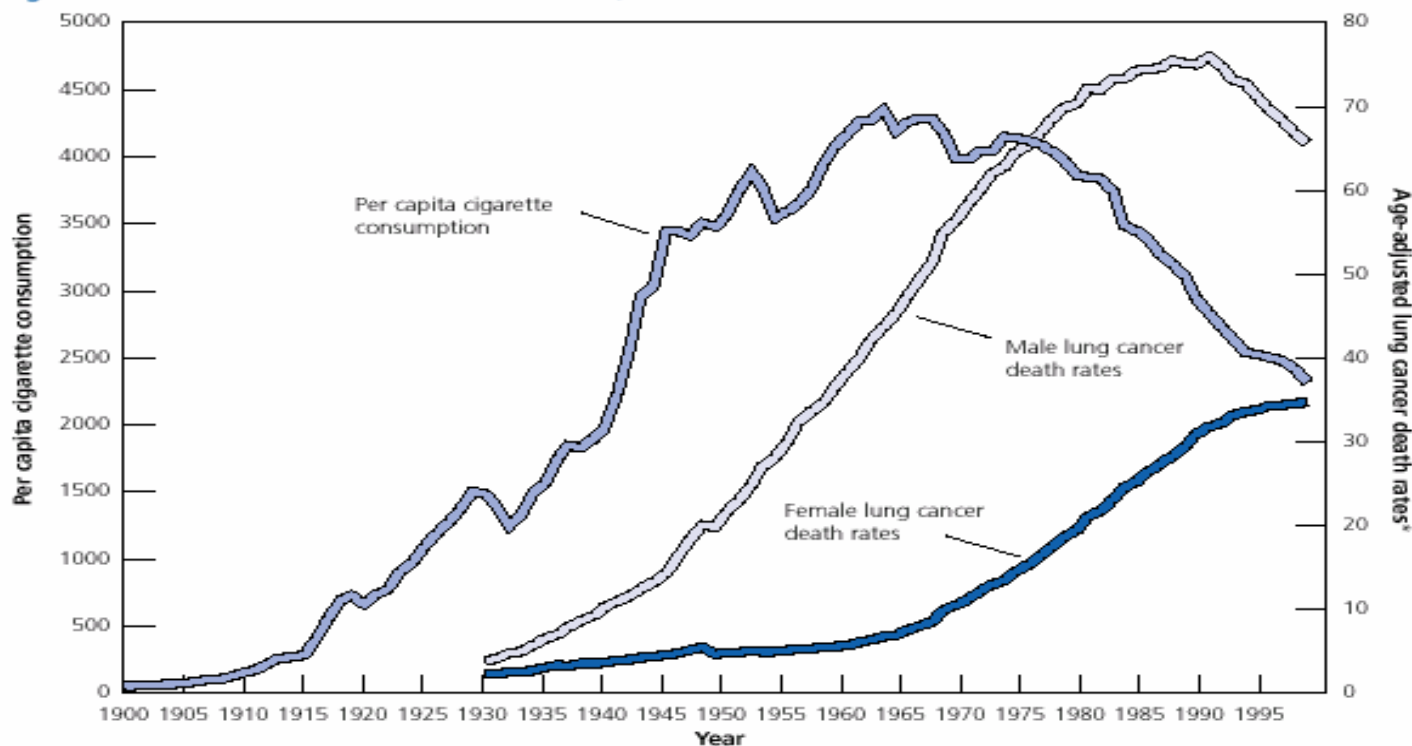


What to do ?



Tabacco Use in the USA

Figure 1A. Tobacco Use in the United States, 1900-1998



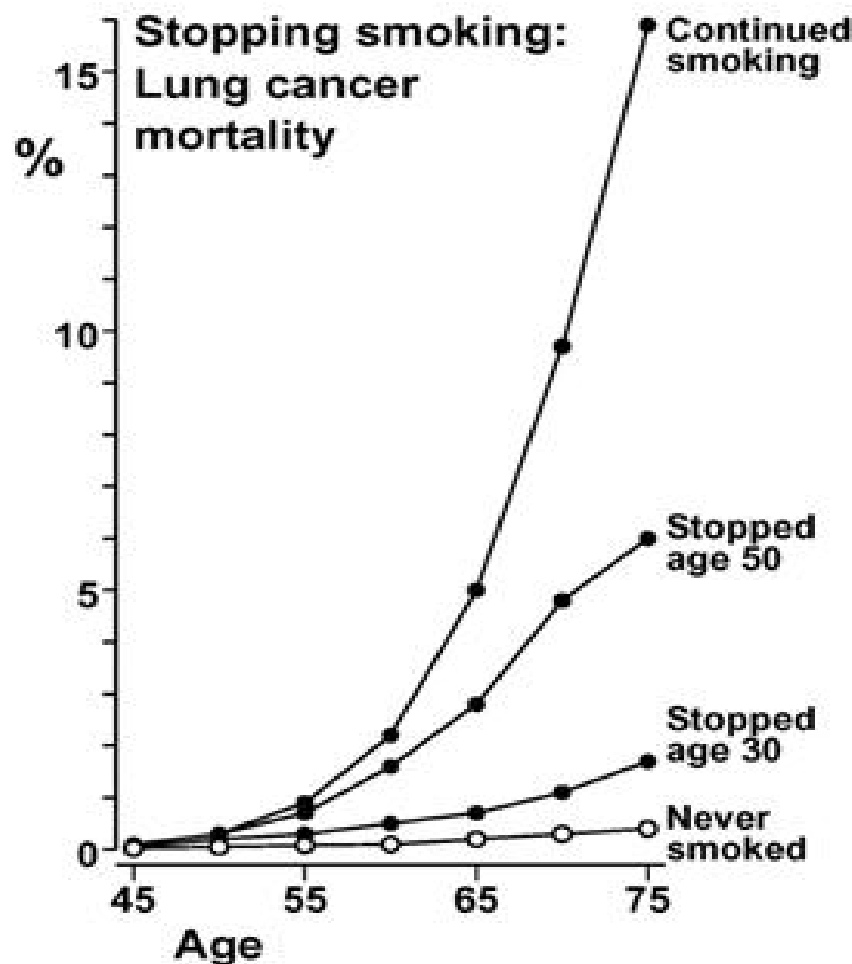
*Age-adjusted to 1970 US standard population.

Sources: Death rates: US mortality public use tapes, 1960-1998, US mortality volumes, 1930-1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2000. Per capita cigarette consumption: US Department of Agriculture, 1900-1987,⁶ 1988,⁷ 1989-1997,⁸ 1998.⁹

American Cancer Society, Surveillance Research



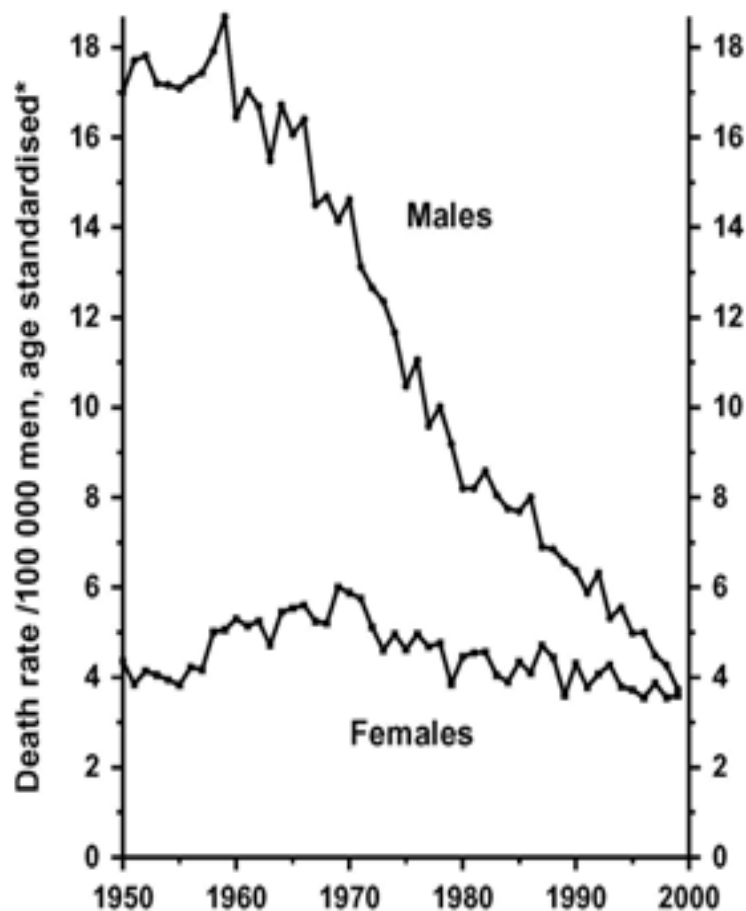
Cumulative risk at
UK male 1990 rates
BMJ 2000;321:323-9





UK

UNITED KINGDOM 1950–1999: Males & Females
Lung cancer mortality at ages 35–44



*Mean of annual rates
in component 5-year age groups

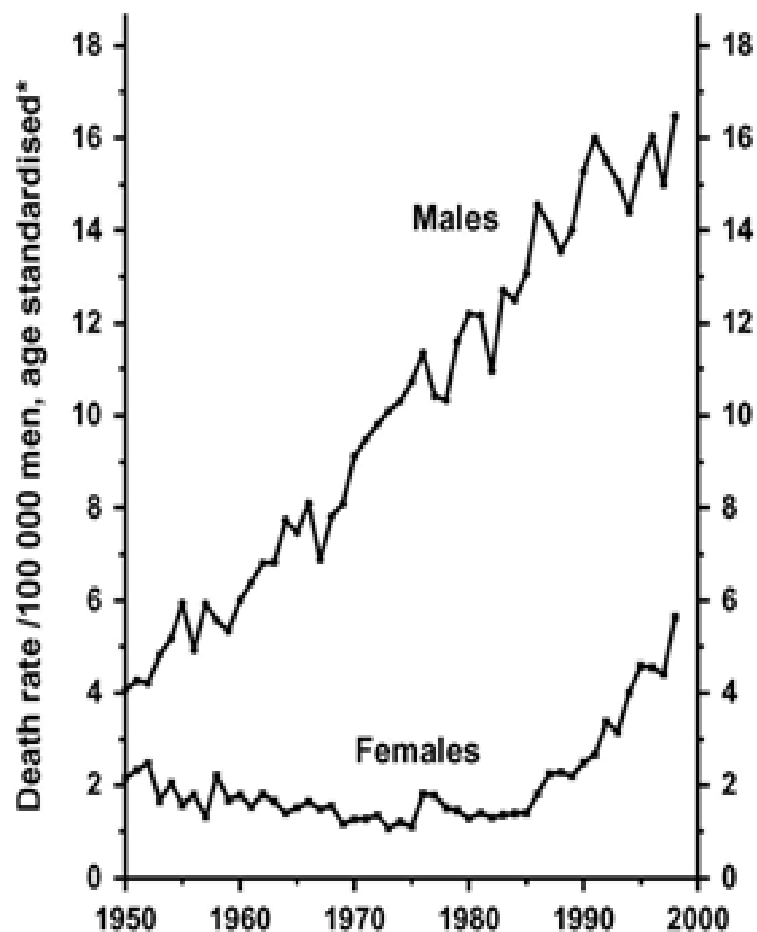
Source: WHO mortality &
UN population estimates

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FRANCE 1950–1999: Males & Females
Lung cancer mortality at ages 35–44

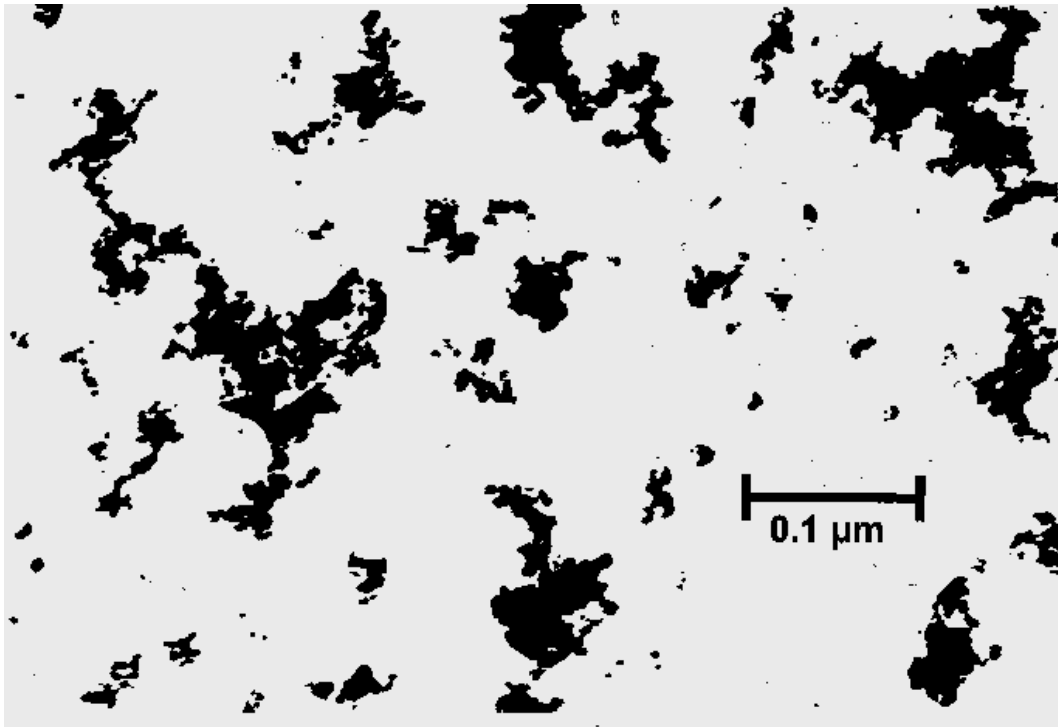


*Mean of annual rates
in component 5-year age groups

Source: WHO mortality &
UN population estimates

11-0001-2001 (4.01.01)

Characteristics of Particulates by Mass und Number Concentration



- Mass
- Number

i.e.: particulates generated by diesel

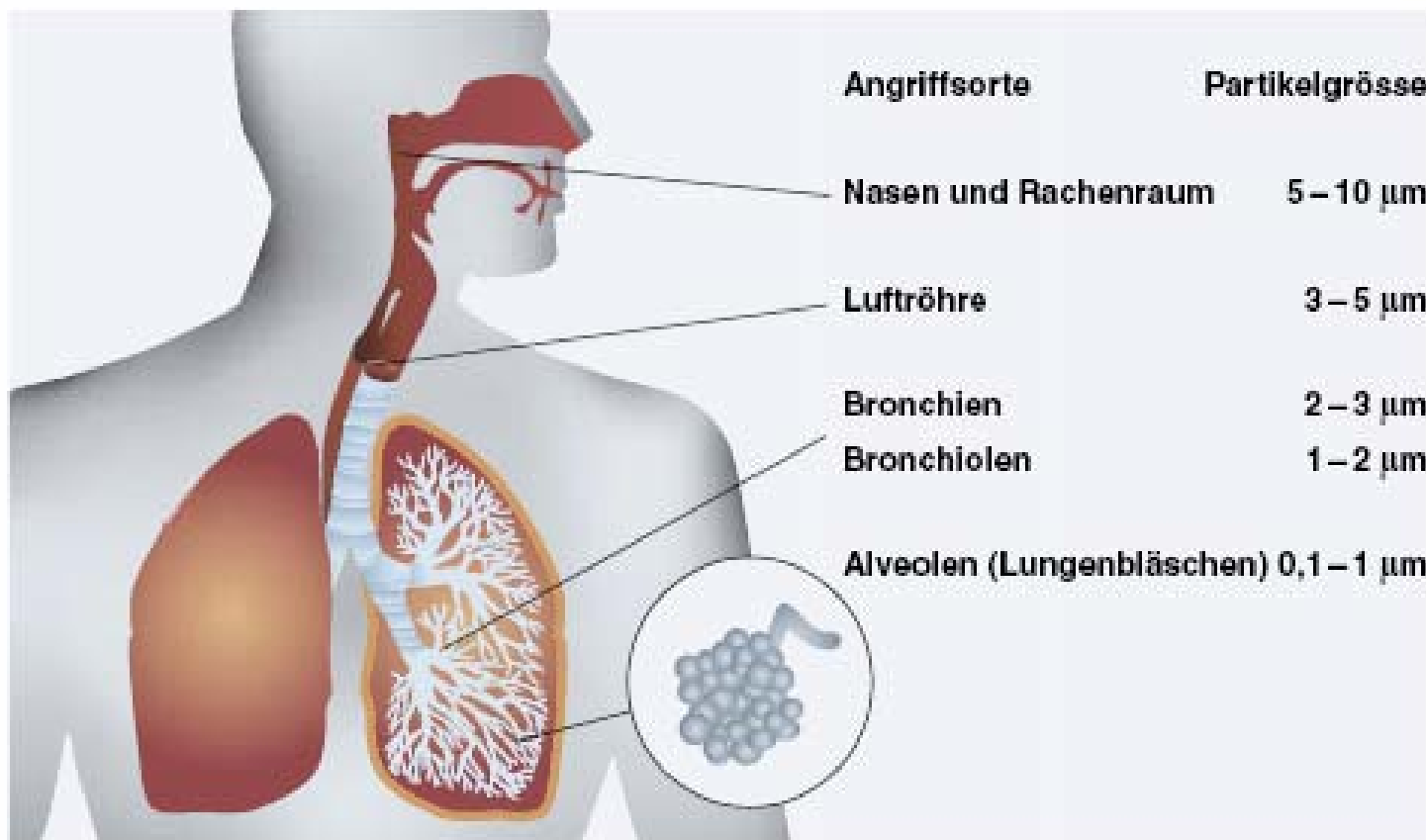
Kreyling et al., GSF-IHB



Particulate Matter (PM)-Emissions in CH

- **PM₁₀** 2000: ca. 23'000 Tons
 - 2010 Trend: ca. 21'000 Tons
 - 2010 max.: ca. 14'000 Tons
- **PM_{2.5}** 2000: approx. 13-17'000 Tons
- **Soot** 2000: approx. 4400 Tons

P. Straehl MPH, BAFU



Angriffsorte des Feinstaubs in den Atemwegen: Je kleiner die Partikel, desto tiefer dringen sie in das Lungensystem ein.



Air Pollution and Premature Death **Worldwide**

- 600'000 death / year
 - 1% of all cardiovascular deaths
 - 3% of all respiratory tract cancers
- 7.4 Mio DALY's / year

BMJ 2002, Culland, WHO Report



CH and PM induced health effects

- 3700 premature deaths / y
- 3 Mio citizens inhale too much PM
- 14% of Lung Cancer attributed to $PM_{2.5}$
 - 10mg / m³ median
- 270 Lung Cancer death / y (100 – 450)

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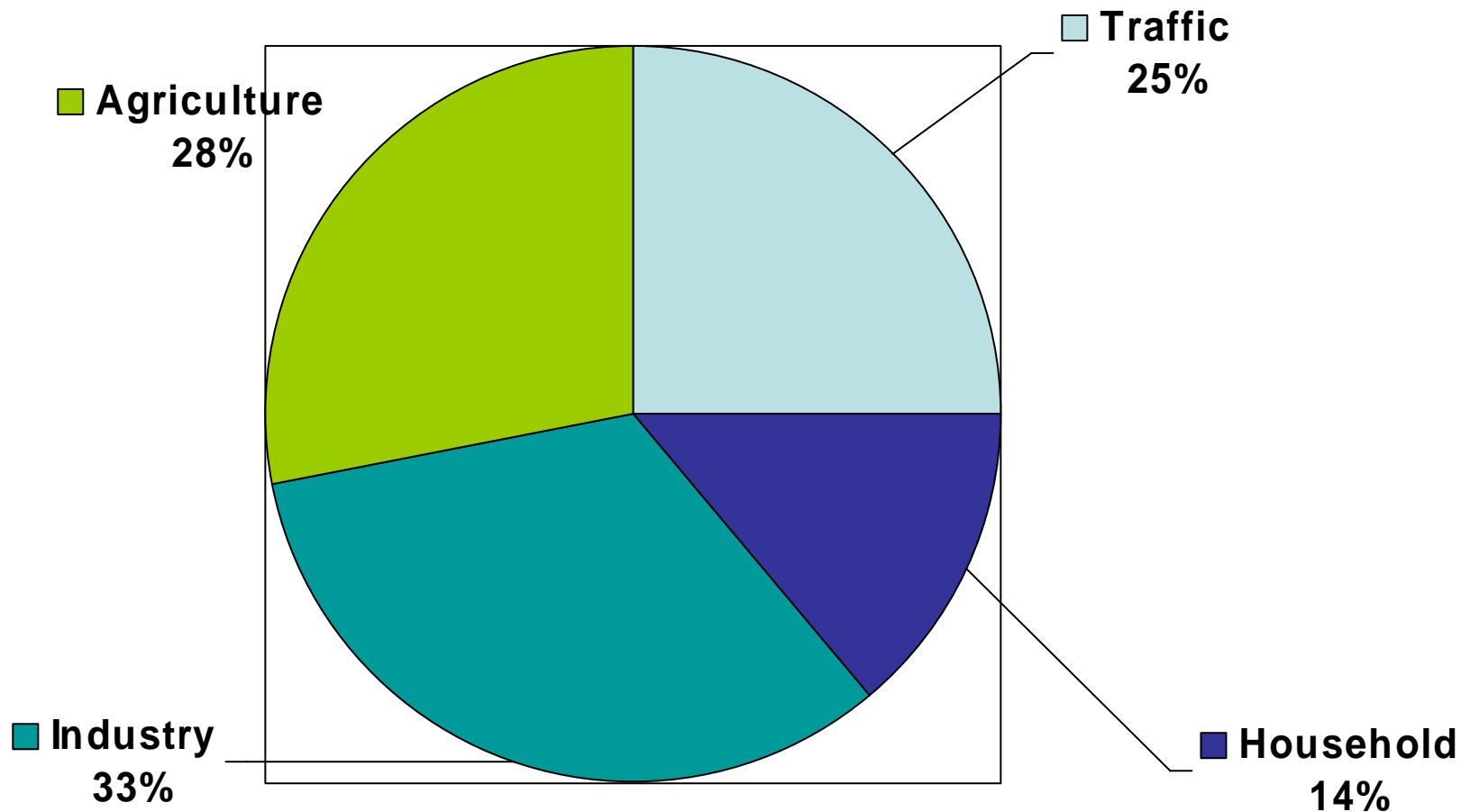
Cancer risk due to Air pollution in CH

- Life time risk: 3/1000 ($3 \cdot 10^{-3}$)
- Allowed USG: 1-10/100'000 ($1 \cdot 10^{-5}$)
 - 30-300 fold excess !
- Needed Reduction of „**Soot**“ : 30fold
- Needed Reduction of „**PM_{2.5}**“: 50%

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CH 2000: PM_{2.5} - Sources



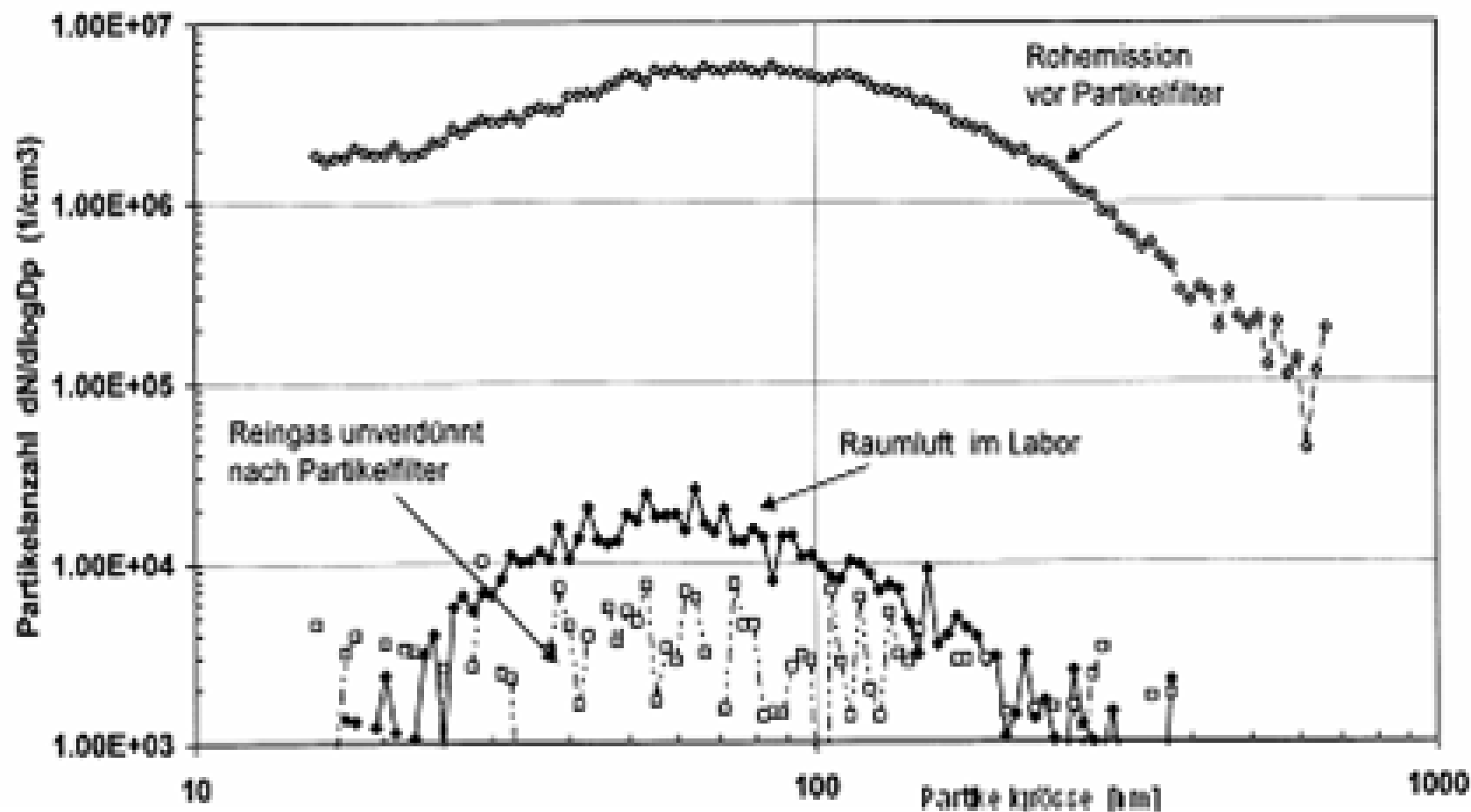


Efficiency of DP-Filtre

- Diesel Particle Filter is able to eliminate 90% of PM mass
- 99% of PM_{2.5} particles (number concentr.)
- 90% Reduction of carcinogenic potential



Highly efficient Diesel Particle Filter



Partikelanzahl um ca. 3 Größenordnungen vermindert



WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide

Global update 2005

Summary of risk assessment



World Health
Organization



Guidelines

PM_{2.5}: **10 µg/m³ annual mean**
 25 µg/m³ 24-hour mean

PM₁₀: **20 µg/m³ annual mean**
 50 µg/m³ 24-hour mean

UF: Ultrafine particles <0.1µm not yet considered





Table 1

WHO air quality guidelines and interim targets for particulate matter: annual mean concentrations^a











	PM₁₀ ($\mu\text{g}/\text{m}^3$)	PM_{2.5} ($\mu\text{g}/\text{m}^3$)	Basis for the selected level
Interim target-1 (IT-1)	70	35	These levels are associated with about a 15% higher long-term mortality risk relative to the AQG level.
Interim target-2 (IT-2)	50	25	In addition to other health benefits, these levels lower the risk of premature mortality by approximately 6% [2–11%] relative to the IT-1 level.
Interim target-3 (IT-3)	30	15	In addition to other health benefits, these levels reduce the mortality risk by approximately 6% [2–11%] relative to the IT-2 level.
Air quality guideline (AQG)	20	10	These are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to long-term exposure to PM _{2.5} .

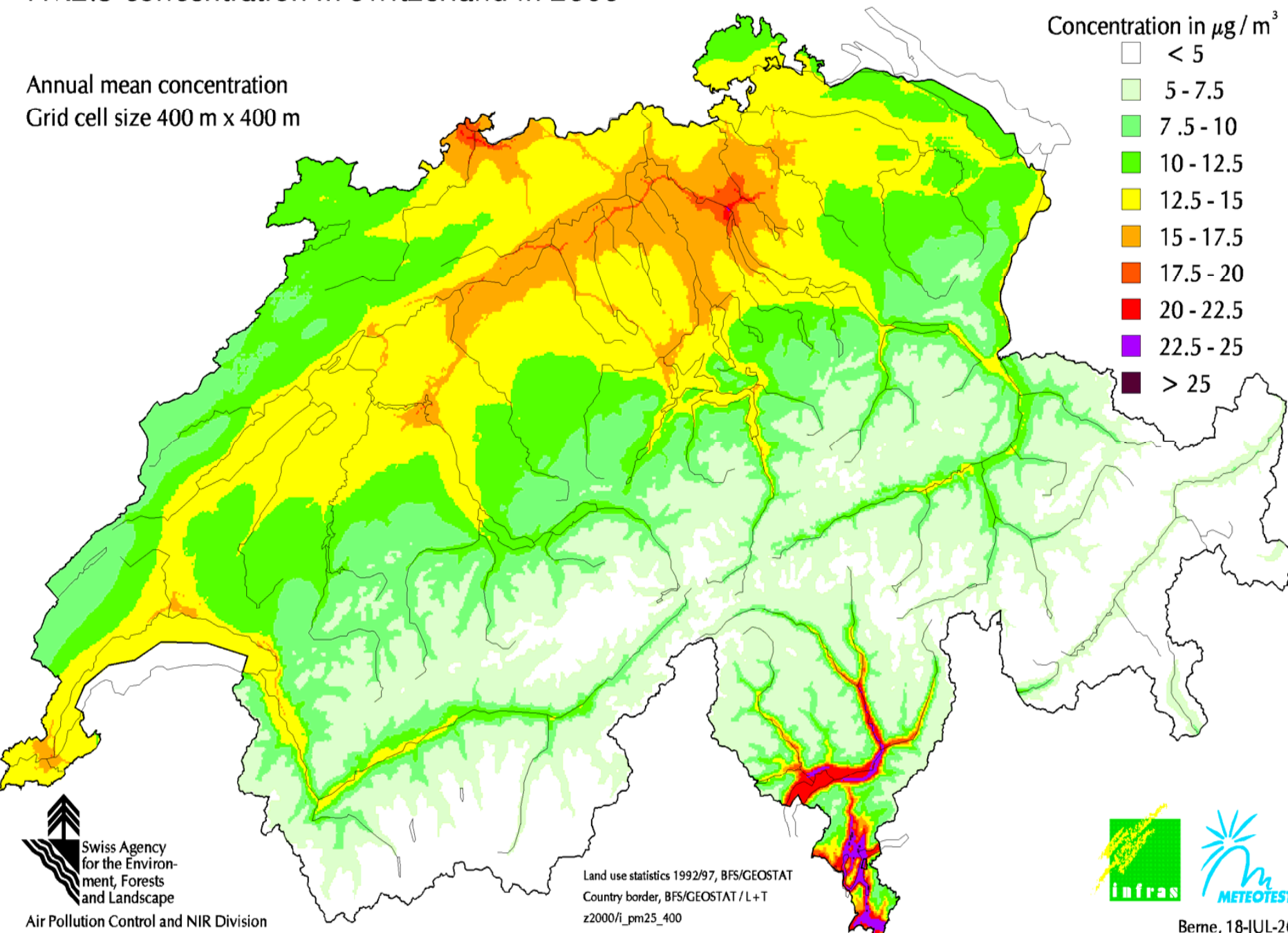


PM2.5 concentration in Switzerland in 2000

Annual mean concentration
Grid cell size 400 m x 400 m

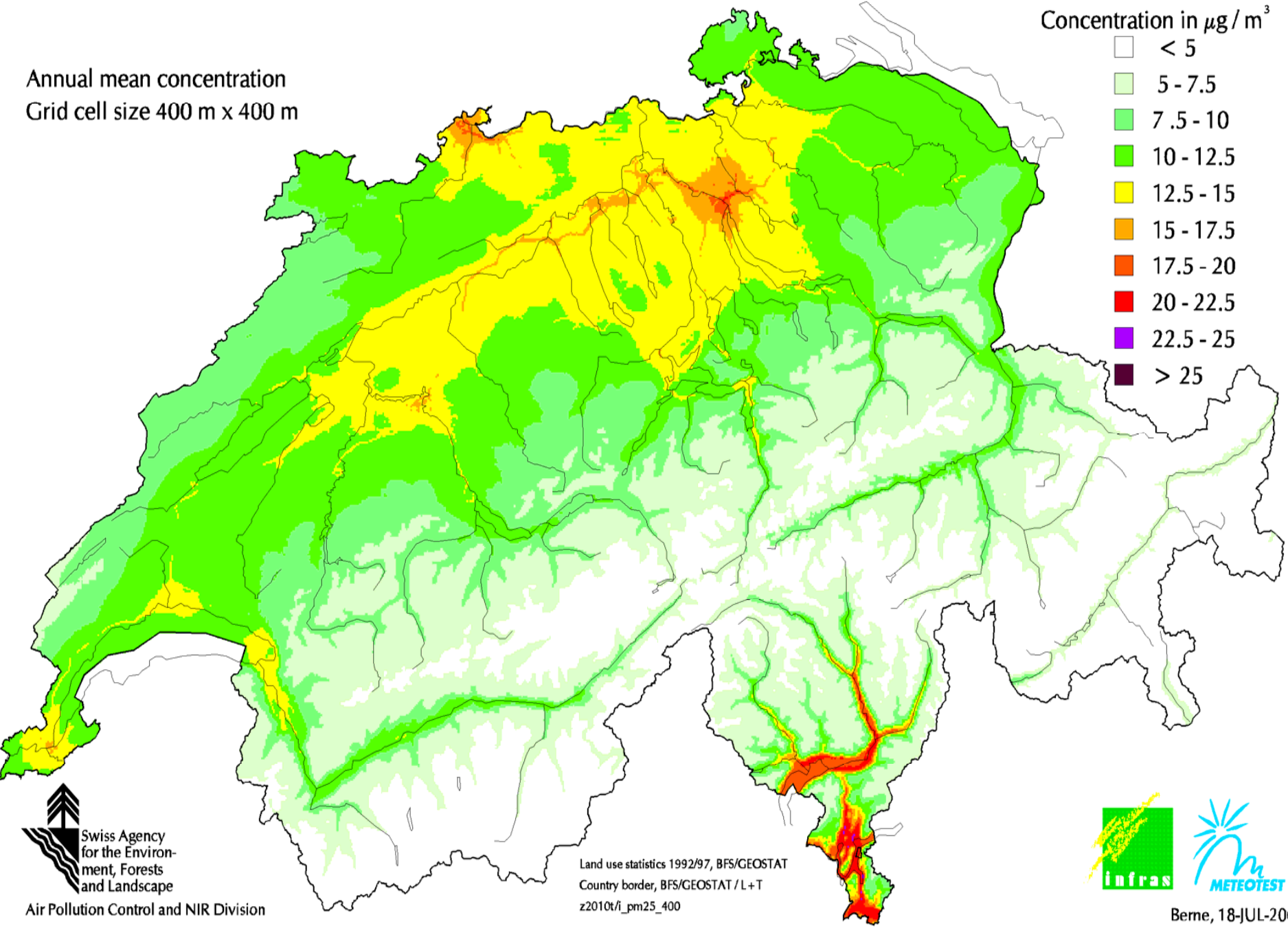
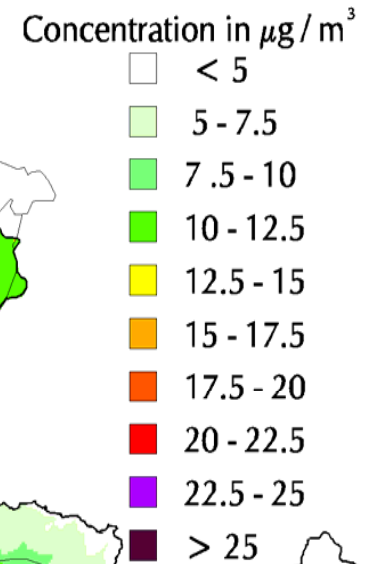
Concentration in $\mu\text{g} / \text{m}^3$

-  < 5
-  5 - 7.5
-  7.5 - 10
-  10 - 12.5
-  12.5 - 15
-  15 - 17.5
-  17.5 - 20
-  20 - 22.5
-  22.5 - 25
-  > 25



PM2.5 concentration in Switzerland in 2010 ('business as usual' scenario)

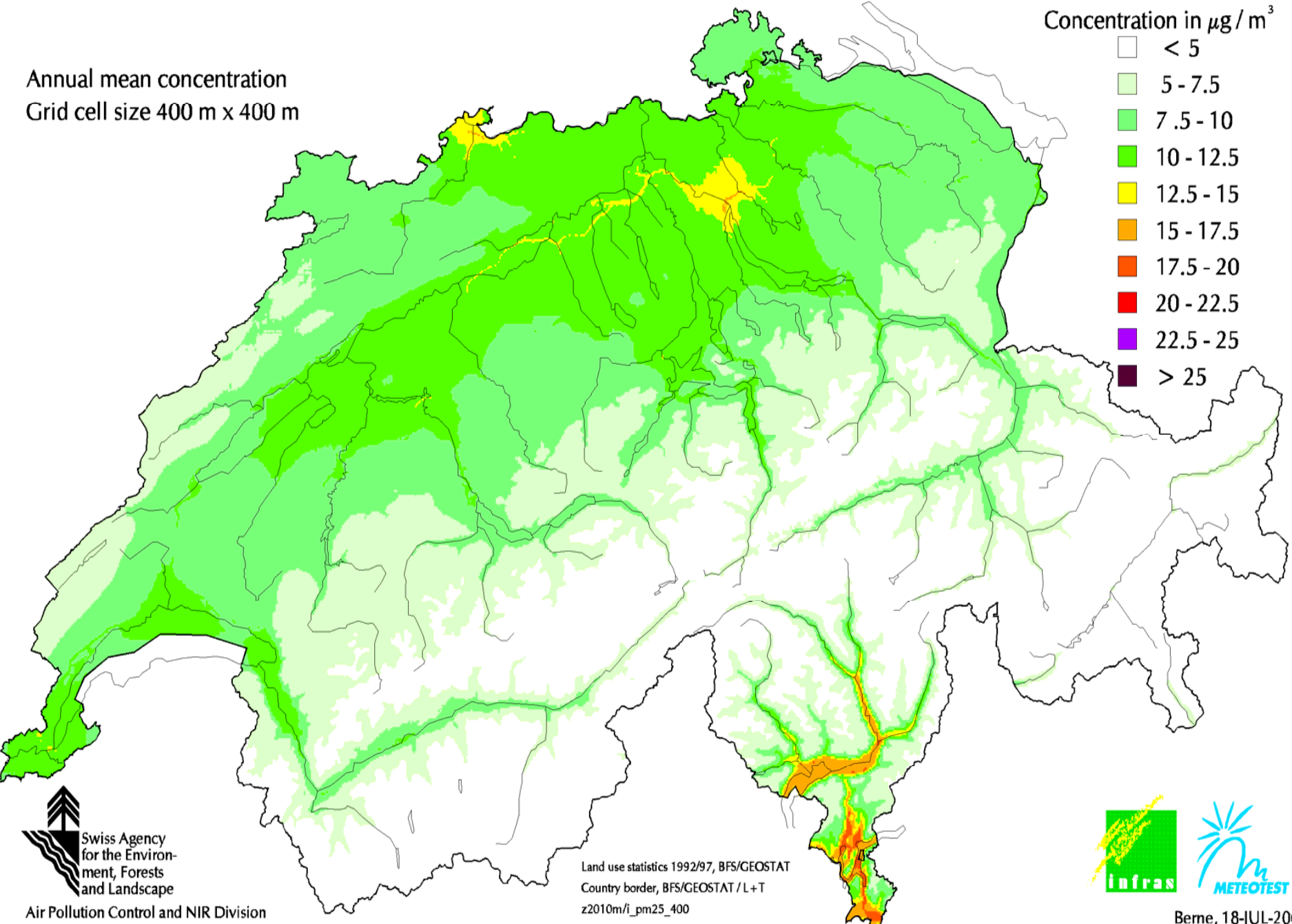
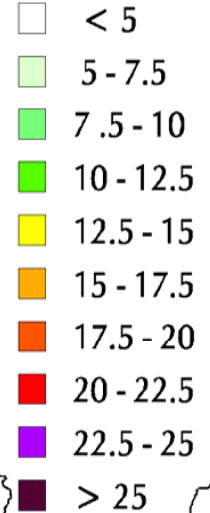
Annual mean concentration
Grid cell size 400 m x 400 m



PM2.5 concentration in Switzerland in 2010 ('maximum feasible reduction' scenario)

Annual mean concentration
Grid cell size 400 m x 400 m

Concentration in $\mu\text{g} / \text{m}^3$





Reachable Goals for Switzerland:

- Reduction of 640 premature deaths including 60 lung cancer deaths/year
- + much more in morbidity reduction !
 - **Costs: 300 Mio/year**
- **Savings: 1'600 Mio/year and of course reduction of unnecessary suffering**

Dr. Peter Straehl MPH, BAFU



Laureats Stettler, Mayer, Hirt and Margulies of the Swiss Cancer League Award Ceremony: Geneva 21.9.2006

