Practical Experiences of Aerosol Inventory Preparation – European Perspective

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Issues

• Background and focus

• Process
  – New sources
  – Activity data
  – Emission factors
    • Size distribution
    • Chemical speciation
    • Technology information

• Illustrative results

• Plans for further work
Background and focus (1)

- Stronger focus on effects of aerosols, in particular health effects, over the last years
- Health impacts from particulate matter at a center of the strategy developed within the European Clean Air for Europe programme (CAFE);
- During the revision of the National Emission Ceiling (NEC) Directive the Commission is carefully looking into how a ceiling would be established for PM2.5 emissions in 2015
- Currently main focus is on particle mass by size (PM$_{10}$, PM$_{2.5}$); Data on chemical speciation (e.g. BC and OC) is considered as useful information, but have been of second priority so far; *used for modeling purposes only*
Background and focus (2)

- Convention on Long Range Transboundary Air Pollution (LRTAP) will follow the EU approach
  - Establishment of a UNECE PM Expert Group

- Demand for complete and validated emission inventories
  - Initiated methodology work
    - EMEP/Corinar Emission Inventory Guidebook
    - Datasets for modeling (atmospheric and integrated assessment)
  - Establishment of a PM Task Group under TFEIP to review the immediate requirements of modellers

- Requirement for reporting of PM$_{10}$ and PM$_{2.5}$ annual emissions introduced recently within the Convention (although not linked to obligations); \textit{good response from many countries}
RAINS emission estimates for VOC vs. national inventories, 2000
RAINS emission estimates for PM$_{2.5}$ vs. national inventories, 2000
New sources (1)

• The Emission Inventory Guidebook covers largely the same sources as the IPCC Guidelines
  – Less focus on forest and land-use emissions
  – Sources not relevant in Europe are not included

• Natural PM emissions (wind blown dust, sea salt, volcanoes, biomass burning, pollen) will be addressed in the NatAir project (EU 6th Framework Research programme)

• A number of PM sources are missing in reporting formats and guidelines; several of them, however, relevant only for coarse particles
New sources (not described in current guidance)

• Road non-exhaust (road, brake and tyre wear)
  – (is described in EMEP/Corinair) Of BC/OC relevance
• Landfills (is described in IPCC, mainly coarse)
• Animal houses and crop production
• Heavy construction works
• Wood products (sawmills, particle-/fiberboard, plywood)
• Coal production, handling and storage
• Mineral ore mining processes (incl. handling and storage)
Activity data

• For most sources, existing data can be used, however
  – Need for additional information on combustion technology and management

• Special attention needed for small scale combustion of coal and biomass; *residential use of coal declines in Europe while further increase in biomass consumption projected*
  – ‘Inventory’ of combustion technology
  – Non-commercial biomass consumption ‘statistics’

• Data required for the ”new” sources are often not available from national statistics
Emission factors (1)

- Highest priority for updating the Guidebook are
  - Small-scale and industrial combustion (BC/OC relevant)
  - Processes in iron and steel industries
  - Off-road sources (BC/OC relevant)
  - Residential waste combustion (BC/OC relevant)
  - Burning of agricultural residues (BC/OC relevant)
  - Some ”new sources”
  - (for some sources updates are not needed)
  - Validation of factors across UNECE area

- Literature review
  - Emission factors/shares, size distribution and chemical speciation are not always available from the same source of information

- More measurements
  - Needed for majority of sources and various geographical regions
Emission factors (2)

![Graph showing particle emissions](image)

**Figure 12.** PM emission of 6 wood-fired stoves. Dependency of wood consumption rate. A: catalytic stove, B-D: old stoves, E: open fireplace (Haakonsen and Kvingedal, 2001).
BC, OC emissions in Europe (by region)

RAINS (IIASA) Current Legislation Scenario [Gg], Klimont et al., in preparation

**Black Carbon**

![Black Carbon Graph]

**Organic Carbon**

![Organic Carbon Graph]
Black carbon emissions in Europe (by sector)

RAINS (IIASA) Current Legislation Scenario [Gg], Kupiainen and Klimont, in preparation

Western Europe

Central and Eastern Europe

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<th>Year</th>
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Thousand tons

- Other
- Off-road
- Road - HDV
- Road - LDV
- Residential
- Industry

CICERO
Center for International Climate and Environmental Research – Oslo
Senter for klimaforskning
Black carbon emissions in Europe (by fuel)

*RAINS (IIASA) Current Legislation Scenario [Gg], Kupiainen and Klimont, in preparation*
BC emissions projections for China and Japan

RAINS Current Legislation Scenario [Tg], Klimont et al., in preparation

![Graph showing BC emissions projections for China and Japan]
**PM$_{2.5}$ and BC emissions projections for Russia**

*RAINS* Current Legislation Scenario [Tg], Klimont et al., in preparation

![Graph showing PM$_{2.5}$ and BC emissions projections for Russia](image)

- **PM$_{2.5}$** and **BC** emissions are projected from 1990 to 2030.
- The graph shows emissions from various sectors: Power plants, Industry, Domestic, Road transport, Off-road, Other, and Removed through technology.
- The emissions projections are presented in terms of Mt (megatonnes) for PM$_{2.5}$ and in terms of concentration units for BC.

*Source: Klimont et al., in preparation*
Conclusions and plans for further work

• To a large extent PM inventories can be produced using the same methodologies as other pollutants, but
  – There are additional sources
  – To achieve acceptable accuracy, more information is needed about combustion technologies; *Data on chemical speciation are often not available from the same studies as the size speciation and emission factors*

• Need for more measurements

• Working to improve methodology guidance over the next years
  – New resources may become available; *driven by the current policy debate*
  – *EC research initiative* to know more about the chemical speciation may take place in the years to come