

*La contaminación atmosférica por
partículas en suspensión*

Madrid, 11 de junio de 2002

**Particulate matter and air quality in Europe
Trends and provisions of new EC directive**

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EMISSIONS and HEALTH Unit



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Outline of presentation

- **PM: What are we speaking about?**
- **Is PM really toxic to human health?**
- **What do we need to measure?**
- **What does the EC Directive say?**
- **Why is PM difficult to measure?**
- **Conclusions - The way forward**



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PM10 - What are we speaking about?

Complex nature of particulate matter

- PM from natural and anthropogenic sources
- Primary and secondary particles
- Particles of different diameters and composition
- Core material and adsorbed substances
- Cocktail of different chemical substances

PM10 - What are we speaking about?

Most important emission sources

- Wind blown crustal material, sea salt, biogenic emissions
- Combustion processes: traffic, power plants, industrial and residential heating, forest fires
- Fugitive emissions: extractive industry, loading/unloading of bulk goods, building construction
- Secondary aerosols (sulphates, nitrates, ...)
- Road sanding / abrasion, abrasion of tires and brakes
- Re-suspension of deposited PM



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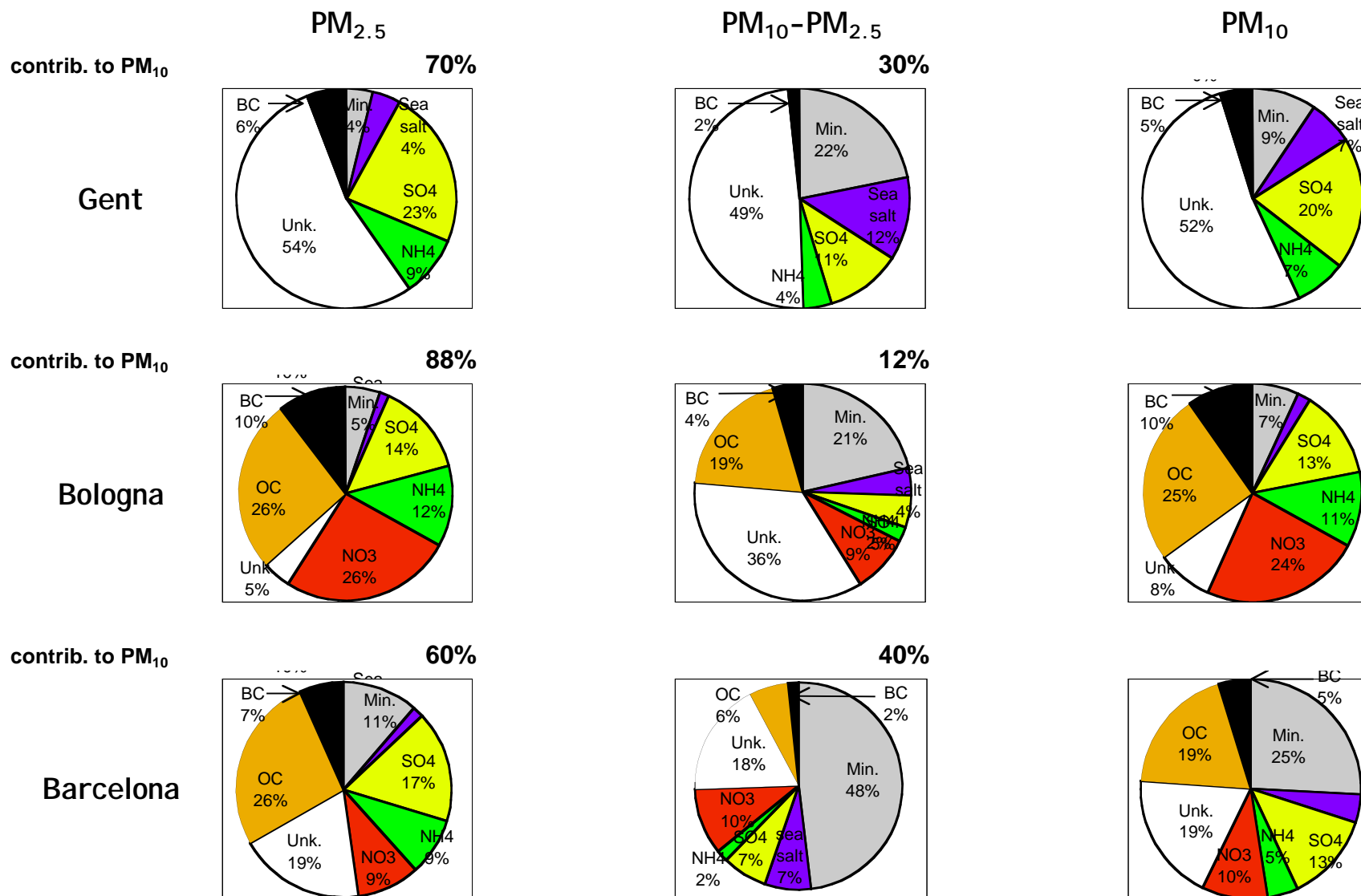


PM10 - What are we speaking about?

A cocktail of different chemical substances

- **Crustal material (silicates, limestone, ...)**
- **Sulphates, nitrates, ammonium salts**
- **Condensed organic material (tar, ...)**
- **Soot / elemental carbon**
- **Sea salt (chlorides)**
- **Sulfuric acid**
- **Metal oxides**
- **Poly-aromatic hydrocarbons**

Data from W. Maenhaut, M.C. Facchini, J.P. Putaud and X. Querol



Is PM really toxic to human health?

Results from US and EC studies

- Increased frequency and severity of respiratory ailments
- Increased risk of premature death among elder people with respiratory or cardiovascular disease
- Health effects occur at very low levels of PM10
- No concentration below which no effect on human health

Is PM really toxic to human health?

Increase in number of cases per year attributable to increase in annual mean PM 10 concentration

PM 10 annual mean increase	Mortality	Hospital admissions
From 15 to 20 $\mu\text{g}/\text{m}^3$	36 (29-43)	38 (23-53)
From 15 to 25 $\mu\text{g}/\text{m}^3$	72 (58-87)	77 (46-107)
From 15 to 30 $\mu\text{g}/\text{m}^3$	108 (87-130)	115 (68-160)
From 15 to 35 $\mu\text{g}/\text{m}^3$	145 (116-173)	153 (91-214)
From 15 to 40 $\mu\text{g}/\text{m}^3$	181 (145-217)	192 (114-267)

Estimated number of cases in population of 1 million people



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What do we need to measure?

What is causing the health effect?

- Shape of particles?
- Dimension of particles?
- Mass of particles?
- Number of particles?
- Surface area of particles?
- Chemical nature of particles?
- Synergy of different effects?

What do we need to measure?

What is the best indicator?

- **Black Smoke (BS)?**
- **Total Suspended Particles (TSP)?**
- **Mass of PM under 10 μm (PM 10)?**
- **Mass of PM under 2.5 μm (PM 2.5)?**
- **Mass of PM under 1 μm (PM 1)?**
- **Sooth / Elemental Carbon (EC)?**
- **Number / surface area of particles?**
- **Chemical speciation (Heavy Metals, PAHs)?**

What does the EC Directive say?

Provisions of the directive

- **Obligation to monitor PM 10 levels**
- **Criteria for network design**
- **Data quality objectives**
- **Recommendation to monitor PM 2.5**
- **Respect imposed limit values everywhere**
- **Inform the population about levels and risks**
- **Explain reasons of exceedences**
- **Develop action plans to improve air quality**

What does the EC Directive say?

Imposed limit values for PM 10

- **50 $\mu\text{g}/\text{m}^3$ (24-h average) not to be exceeded more than 35 times a year from 2005**
- **20 $\mu\text{g}/\text{m}^3$ (yearly average) to be met by 2010 (subject to review in 2003)**

What does the EC Directive say?

PM standards currently in force

	Time period	PM 10	PM 2.5	(in $\mu\text{g}/\text{m}^3$)
USA - EPA	Daily	150	65	
	Annual	50	15	
California	Daily	50	Not set	
	Annual	20	12	
EU	Daily	50	Not set	
	Annual	20	Not set	

Why is PM difficult to measure?

Main problems encountered

- No reference material => no calibration possible
- Selection of reference method by convention
- Manual gravimetric method standardized by CEN
- On-line β -attenuation and TEOM monitors in networks
- Possible artifacts: Wrong inlet cut-off
Poor flow-control
Effect of humidity => heating of sample
Loss of volatile material

Why is PM difficult to measure?

Problems with automated PM monitors

- Heating sample leads to losses of volatile components
- Observed losses from 0 to 30%

=> Interim agreement

- MS have to establish correction factor
- If not, default factor of 1.3 to be used

Conclusions - The way forward

What is further needed?

- **Reliable automated PM10 and PM2.5 analysers**
- **Effective QA/QC programme for PM measurements**
- **More research on health effects of PM**
- **Definition of better health indicators**
- **Reliable PM emission inventories**
- **Validated PM dispersion models**
- **Assessment of abatement scenarios**
- **Implementation of action plans**

=> Possible role of natural gas community