Trends in emissions and control policies for fine dust particles in Germany

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Abstract

The presentation is on primary, anthropogenic fine particles. We will show the historical trend of fine dust emissions and projections up to 2020 as well as measures and regulations to reduce emissions and influence their trends. Furthermore we will deal with the latest policies in the combat against dust.

Keywords: dust emission, dust projection, policy measures

Introduction

Dust emissions, especially their fine fractions cause unhealthy high concentration in the air in many areas in Germany (By the end of 2006 58 German cities had developed a clean air plan, i.e. that they did not achieve the air quality standard for PM10. The Federal Environment Agency publishes a list of these cities: http:// www.env-it.de/luftdaten/download/public/html/Luftreinhalteplaene/uballl.htm). In addition to the primary dust emissions, the secondary emissions stemming from precursors such as sulphur dioxide, nitrogen oxides, ammonia and volatile organic compounds contribute to elevated levels above the ambient air quality standards. Both, the primary and the secondary particles are due to a wide range of economic, private and natural activities.

The focus of this presentation is on primary, anthropogenic fine particles (i.e. caused by human activities). In this presentation we will show the historical trend of fine dust emissions and projections until 2020 as well as measures and regulations to reduce emissions and influence their trends. Furthermore we will deal with the latest policies in the combat against dust. Ambient air concentrations and their unhealthy effects are not subject of the presentation.

Trend of emissions and regulations for their reduction

Dust is mainly emitted by fuel-burning, which partially serves the generation of energy and the use of vehicles. Other mayor emitting sectors are the handling of bulk materials, production processes, especially the iron & steal works and the mineral industry as well as agricultural activities.

About 40 years ago the two parts of Germany emitted more than 3 million tons of dust per year, with an increasing tendency, even that there were already regulations in place for fitting major new plants with filters. Since that time, and comprehensive and integrated under the 1974 Act of Federal Immission Control (Bundes-Immissionsschutzgesetz - BImSchG), a system of ordinances and technical instructions on emission prevention and control has come into effect and has reversed the trend of growing emissions.

A basic feature of the Federal Immission Control Act is the precautionary principle, which means in practical terms

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that all sources (new and old) must prevent and control emissions according to the state of the art:

1. The establishment and operation of listed plants particularly liable to cause harmful effects on the environment are subject to licensing, relevant smaller installations need type-approval. PM emission control requirements reflecting state of the art technology are laid down in the ordinance on large combustion plants, the Technical Instruction Air (TA Luft) for all other plants subject to licensing and in the ordinance on small combustion plants (<1 MWth).
2. Mobile sources need a type-approval in which the pursuant to EC Directives regulated emissions are tested.

As a consequence of environmental protection policy total dust emission was reduced by over 90 % to about 300 kt in the year 2005. The reduction of dust emissions between 1990 and 2000 of about 1.6 Mt per year was mainly achieved in the new Länder, either by closing old and inefficient power plants and industrial plants, by improving efficiencies of plants and by emission control equipment. Of further significance was the switch from solid fuels to less polluting liquid and gaseous fuels – especially in smaller plants.

Basis for official emission data is the emission data base of the Federal Environment Agency „Central System Emissions – ZSE“ (ZSE, 2005), which is structured according to international reporting guidelines (United Nations Intergovernmental Panel on Climate Change (IPCC): IPCC Guidelines for National Greenhouse Gas Inventories, Reporting Instructions, IPCC-Guidelines http://www.ipcc-nggip.iges.or.jp/public/gl/invsl.htm and of the European Agencie`s Coordination of Information on Air CORINAIR Atmospheric Inventory Guidebook - 2005, CORINAIR-Handbook http://reports.eea.eu.int/EMEPCORINAIR4/en). A break down of the dust emissions by sector is presented in table 1.

Projections for dust emissions

The dust emission inventory of the ZSE was reviewed and adapted to best available scientific knowledge in 2005/6 (UBA, 2007). It now includes all relevant emission sectors. It distinguishes total dust emissions, and according to particle size, PM10 and PM2.5. Sectors new in the emission inventory are abrasion by traffic and the so far hardly elaborated other sources such as cigarette smoke, fireworks and barbequing.

Table 1:
Dust emissions by sectors in Germany, kt

NFR	Quellgruppe	PM	PM10	PM2.5
1 A	**Verbrennung von Brennstoffen**	**108.20**	**70.49**	**52.06**
1 A 1	Energieindustrie	13.06	9.73	8.39
1 A 2	Produzierendes Gewerbe	2.18	2.01	1.64
1 A 3	Transport	56.88	35.09	20.22
1 A 4	Andere Sektoren (Haushalte + Kleinverbrauch)	35.81	23.41	21.54
1 A 5	Andere: Militär	0.27	0.26	0.26
1 B	**Flüchtige Brennstoffemissionen**	**2.45**	**0.71**	**0.35**
1 B 1	Feste Brennstoffe	2.45	0.71	0.35
2	**Industrieprozesse**	**70.97**	**37.58**	**13.00**
2 A	Mineralstoffindustrie	23.53	12.54	4.30
2 B	Chemische Industrie	0.65	0.46	0.29
2 C	Metallproduktion	44.24	22.90	7.34
2 D	Andere Industrieprozesse	2.54	1.68	1.07
4	**Landwirtschaft (PM10)***	**20.52**	**19.86**	**4.39**
4 B	Tierhaltung (Wirtschaftsdünger-Management) (PM10)*	19.33	18.67	4.39
4 D	Bewirtschaftung von Ackerland (PM10)*	1.19	1.19	0.00
6	**Abfallwirtschaft**	**0.01**	**0.01**	**0.01**
6 C	Müllverbrennung: Krematorien	0.01	0.01	0.01
7	Sonstiges	92.80	41.57	17.62
7 A	Schüttgutumschlag	48.35	22.90	4.58
7 B	Sonstiges	44.45	18.66	13.04
	Summe	**294.94**	**170.22**	**87.43**

* Für die Landwirtschaft wurden keine Gesamtstaub-Emissionen berechnet, deshalb werden hier die PM10-Emissionen aufgeführt.

Based on emissions control measures and regulations, that were already in place in 2005, projections to 2020 are shown in figure 1 by sectors and in figure 2 by fractions. The major feature of the future trend of PM-emissions is the substantial decrease, triggered by regulations already in place. The decrease of emissions for all fractions will be quite substantial and will amount to 40 % for PM2.5, 31 % for PM10, and 27 % for total dust.

A breakdown of total emission shows significant differences in the shares of dust fractions of emitting sectors over time.

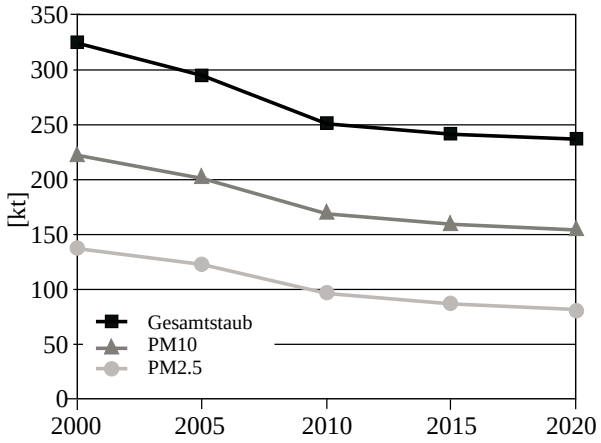

Figure 1:
Primary dust and fine dust emissions in Germany 2000 - 2020

When it comes to total dust, figure 2 shows that emissions are scattered widely over the sectors. On the other hand for PM2.5, which figure 2 does not show, emissions are limited to the sectors road traffic, wood firing, mobile machines, large combustion plants and the ore and steal industry. Agricultural activities also contribute significantly to dust emissions. At the moment agriculture produces 10 % of primary PM10 with a slightly lower share for PM2.5.

For wood burning the emissions depend on the assumptions on the future use of wood. The projections provided in the figures do not include the latest policies and trends of the use of bio fuels. Therefore the emissions for wood firing are underestimated as the use of wood has increased substantially and will grow further. This would lead to a substantial increase of dust emissions without further reduction measures. To cope with this development the Ordinance for small firing installations is under revision with stringent emission limit values.

Outlook

Reducing emissions of fine particulate matter is, in principle, possible for all sources other than natural. With a view to the need for further emission reductions, the German Federal Environment Agency has examined additional measures and their realisation potential. This led to the identification of measures for coal-fired power plants, small-scale wood burning, road and other transport as well as for non-road mobile machinery. The combination of all

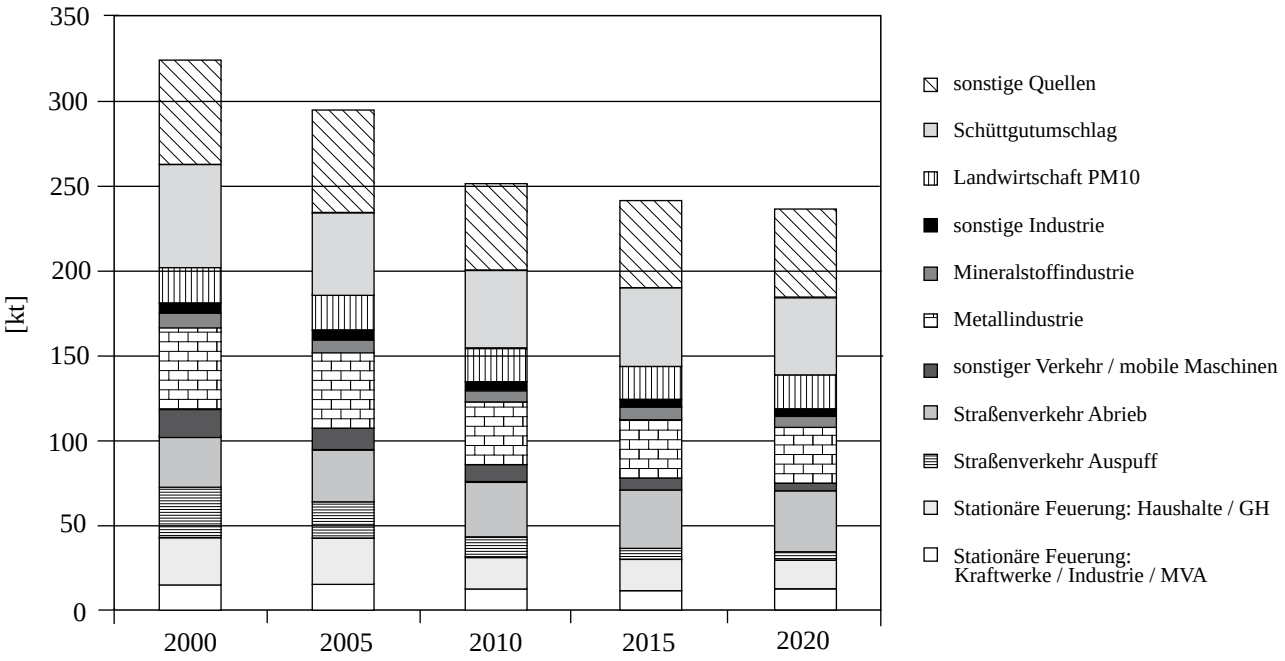

Figure 2:
Breakdown in sectors of the total primary dust and trend of emissions in Germany 2000-2020

measures analysed can reduce emissions of PM2.5 in the reference scenario by 3.3, of PM10 by 2.0 % and of total particulate matter by 1.6 % by 2020.

Due to long-range transboundary transport of particulate matter and precursor substances, national regulations are not sufficient. As part of its air pollution control policy, the EU has developed a strategy to reduce pollution by particulate matter under its Clean Air for Europe Programme and has started revisions of the First Daughter Directive on Air Quality and the NEC Directive. In 2008 the European Commission is expected to propose an update to the NEC Directive up to the year 2020. In addition to defining new national emission ceilings for the substances covered by the present Directive, it is considering introducing national emission ceilings for fine particulate matter (PM2.5).

The United Nations Economic Commission for Europe (UNECE), whose Member States cover a geographical area even larger than that of the EU, has also put pollution by particulate matter on its agenda and will update the so-called Multi-component Protocol to the UNECE Convention on Long-range Transboundary Air Pollution.

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