1. Introduction

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1. THE AIR POLLUTION POLICY FIELD

The Air Pollution policy field covers the gaseous pollutants existing in the atmosphere as a result of human activities. This includes the release of primary pollutants such as sulphur dioxide, nitrogen oxides and volatile organic compounds, which result from the combustion of fossil fuels, industrial processes and agricultural practices, and the formation of secondary pollutants, such as ozone, resulting from the reaction of some primary compounds in the atmosphere. This policy field also includes the issue of acidification, which is the result of emissions of sulphur dioxide and nitrogen oxides reacting in the atmosphere with water, oxygen and oxidants to form acidic compounds, thus causing acidic deposition. The impacts of these various types of air pollution, as explained in the chapters in this part of the volume, include adverse effects on human health, natural ecosystems, agriculture and forestry, and historic buildings. Since current levels of many air pollutants are above accepted national and international standards in most European countries, this policy field is of great relevance to Europe.

Within the above definition of the Air Pollution policy field a wide range of pressure indicators was suggested by experts in the first-round questionnaire. For the second-round questionnaire this list was reduced to the 27 that were considered to be most relevant and the indicators were divided into four groups covering emissions, agriculture, energy-related activities and transportation.[1]

2. RESULTS OF THE SECOND-ROUND QUESTIONNAIRE

Figure 1.1 shows the top 15 core-ranked indicators for the Air Pollution policy field, along with the corresponding rankings for the three quality questions. The top five rankings for the four questions were as follows:

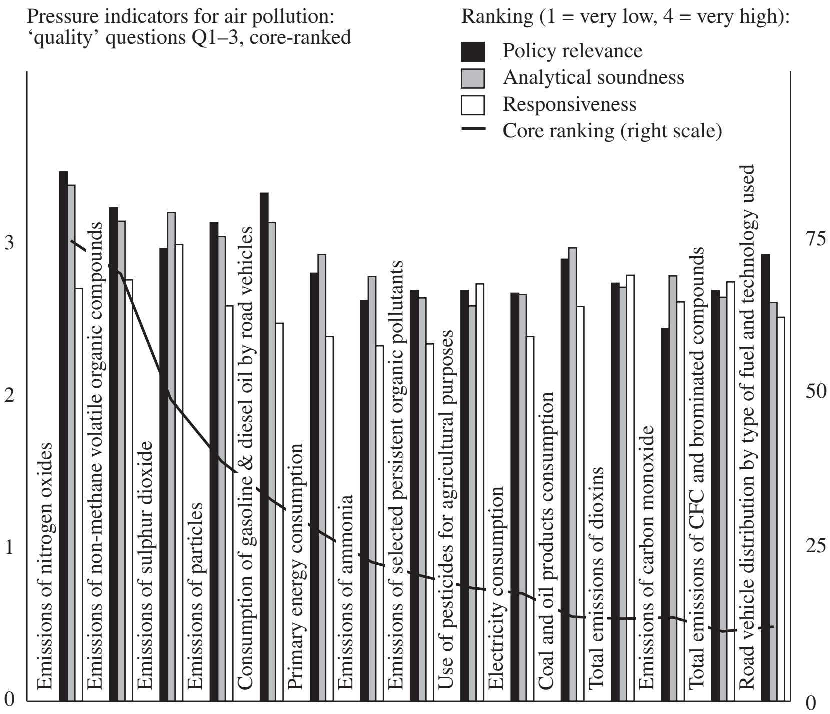

Figure 1.1 Results of second-round questionnaire for the Air Pollution policy field

- Core-ranked indicators: emissions of nitrogen oxides (NO_x), emissions of non-methane volatile organic compounds (NMVOCs), emissions of sulphur dioxide (SO_2), emissions of particles, gasoline and diesel oil consumption by road vehicles.
- Policy relevance indicators: emissions of nitrogen oxides (NO_x), gasoline and diesel oil consumption by road vehicles, emissions of non-methane volatile organic compounds (NMVOCs), emission of particles, emissions of sulphur dioxide (SO_2).
- Analytical soundness indicators: emissions of nitrogen oxides (NO_x), emissions of sulphur dioxide (SO_2), emissions of non-methane volatile organic compounds (NMVOCs), gasoline and diesel oil consumption by road vehicles, emissions of particles.
- Response elasticity indicators: emissions of sulphur dioxide (SO_2), emissions of dioxins, emissions of non-methane volatile organic compounds (NMVOCs), emissions of CFC (chlorofluorocarbon) and brominated compounds emissions, use of pesticides for agricultural purposes.

These results show a high correlation between the top five rankings for all four questions with indicators for emissions of NO_x, SO_2, NMVOCs and particles featuring in at least three of the top five lists. This indicates the high level of agreement in the scientific community about the primary responsibility for pollution occurrences such as photochemical smog and acid rain. There is less consistency between the responsiveness rankings and those of the other questions. There is also less consistency between the quality question rankings and the core rankings for indicators below the top five. However, this does not represent a substantial difference in importance attached to indicators between the questions since, for positions 6 to 15, there is very little difference between the actual level of expert responses given for each question.

3. RELATIONS TO OTHER POLICY FIELDS

There are strong links between the Air Pollution policy field and several of the other policy fields, and some of the pressure indicators relevant to air pollution have been ranked relatively highly in other policy fields. For example, emissions of selected persistent organic compounds and emissions of dioxins are included in the Dispersion of Toxic Substances policy field core rankings, and use of pesticides for agricultural purposes is included in the Loss of Biodiversity and Dispersion of Toxic Substances policy fields core rankings.

Some indicators have been excluded from the final ranking because they are particularly relevant to other policy fields, for example, emissions of carbon dioxide are considered in the Climate Change policy field. The relationship with the Climate Change policy field is important because measures taken to reduce carbon dioxide emissions will influence the emissions of other air pollutants as well. A further link exists due to the cooling effect of aerosols resulting from emissions of sulphur dioxide and soot (causing acid rain). Reduction of emissions of these aerosols will result in a decrease of the regional cooling effect and make the warming of the atmosphere more apparent in highly industrialized regions. This means that an improvement in the pressures related to acid rain and regional air pollution results in a worsening in pressures related to climate change.

Links to the Ozone Layer Depletion policy field exist because tropospheric pollution (ozone and particles) in industrial regions has partly masked the effects of ozone depletion in these regions. An indicator for emissions of CFCs and brominated compounds is included in the core rankings for the Air Pollution policy field.

There are particular associations with the Urban Environmental Problems policy field and some air pollutant emission indicators are ranked relatively highly in the results of the second-round questionnaire. In order to avoid overlap, the Air Pollution policy field considers the regional scale (for example Mediterranean countries or Nordic countries, or Europe as a whole) as opposed to the urban context.

Treatment of waste (for example, incineration) can cause air pollution, depending on the waste type and the technology applied. However, highly ranked waste indicators relate to types of waste and waste treatment rather than emissions from waste. Air pollution indicators concentrate on the total emissions of various pollutants and include, for example, 'emissions of dioxins', which is related to waste incineration.

4. APPROACH OF THE CONTRIBUTORS

The chapter by Professor Papagiannakopoulos gives a clear overview of the important pressures in the Air Pollution policy field, the actions required to reduce these pressures and the role of pressure indicators. He starts by identifying the main impacts of air pollution and acidification as those on human health and air quality, natural ecosystems, agriculture and forestry, and cultural heritage. Short- and medium-term actions to reduce these pressures are outlined as: (i) reduction in emissions of air pollutant gases (described by sector), (ii) improvement of materials, (iii) reductions in acidity, (iv) control of transboundary atmospheric pollution, and (v) improvements in scientific knowledge. A framework of long-term strategies is also presented. Professor Papagiannakopoulos concludes by giving an explanation of the benefits of pressure indices in general terms. He stresses the importance of a scientific consensus about the relative weighting of pressure indices, and warns that statistical information often fails to follow and describe the rapid changes in the environment.

Bjarne Sivertsen starts his chapter with an explanation of the concept of air quality indicators and discusses the selection of these indicators in his outline of problems related to urban air quality and acidification. Along with Professor Papagiannakopoulos, he points to the changing nature of the main air pollutants in recent years. Formerly these were linked to the burning of fossil fuels, but in recent years pollutants such as nitrogen dioxide, ozone and 'a reactive mixture of secondary air pollutants originating from road transport and other mobile sources' have become increasingly important. Therefore, actions recommended in Sivertsen's chapter stress the need to reduce the impact of road transport, and the importance of international cooperation in reducing the impact of the most common air pollutants on the environment. He also outlines the steps needed for a cost–benefit analysis of measures aimed at reducing a specific air quality indicator.

David Guinnup and Christine Sansevero from the US Environmental Protection Agency (USEPA) begin by outlining what they regard as the eight most common air pollutants, namely, carbon monoxide, lead, ozone, nitrogen dioxide, sulphur dioxide, volatile organic compounds and fine and coarse particulate matter. They then focus on these eight pollutants when addressing actions needed to reduce pressures and the benefits of such reductions. Their list compares reasonably closely with the core-ranking results for the Air Pollution policy field. Differences between the lists can be partly accounted for by the inclusion of source-based indicators, particularly related to energy consumption, in the PIP questionnaire. In their list of actions the EPA authors stress the need to reduce primary pollutants by subjecting emissions from electric utilities, road transport and various industrial processes to control programmes which could include installation of pollution control devices, increasing process efficiency and introduction of alternative raw materials. They point out that it is more difficult to develop control strategies for secondary pollutants because the mixtures of primary emissions that cause these are often location-specific. In conclusion, they argue that in the long term it is not enough to develop pollution control actions. Instead, pollution prevention measures must be developed to reduce expanding environmental pressures generated by worldwide growth.

5. INTERNATIONAL FRAMEWORK

The major international agreement relating to air pollution is the UNECE Convention on Long Range Transboundary Air Pollution (LRTAP), which was first adopted in 1985 and commits signatories to reductions in emissions of transboundary fluxes within agreed timetables and to present national emission data annually. The LRTAP includes protocols for sulphur dioxide (1985 and 1994), nitrogen oxides (1988) and volatile organic compounds. The need to comply with this convention has helped to drive the development of international integrated emission inventories such as the CORINAIR90 inventory for European countries.

The Protocol on Long Term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe (EMEP) was adopted in 1984 and ratified by 30 countries. Over 100 monitoring stations are now part of the EMEP monitoring system.

As noted above, measures taken to reduce carbon dioxide emissions will influence the emissions of other air pollutants. Therefore, the Framework Climate Change Convention adopted at the UN Conference on Environment and Development in 1992 is likely to have important impacts on Air Pollution indicators even though it is primarily aimed at reductions in greenhouse gases.

A series of EC directives has been aimed at reducing emissions of air pollutants. In particular these have included directives concerning transport and industry.

In the case of transport, the original directive (70/220/EEC) on vehicle emissions laid down technical standards for emissions of carbon monoxide and unburned hydrocarbons. This has been amended and updated nine times to include NO_x emissions (77/102/EEC) and particulate emissions (88/436/EEC) and to lower limits in a number of ways.

In the case of industry, the Air Pollution from Industrial Plants Directive (84/360/EEC) was the first framework directive in the Air Pollution policy field. It required that Member States set up a permit system for air emissions from certain industrial activities, establish a procedure for the Council to adopt emission limits, and take steps to identify and improve air quality in particularly polluted areas or those which needed special protection. Subsequently, the Limitation of Emissions of Certain Pollutants from Large Combustion Plants Directive (88/609/EEC) was adopted for combustion plants for the production of energy with a thermal input of 50 megawatts (MW) or more. The goal was to achieve a 58 per cent reduction in SO_2 emissions in the Community as a whole by 2003 and a somewhat lower reduction in NO_x emissions.

Other relevant directives include those for Prevention of Air Pollution from New Municipal Waste Incineration Plants (89/369/EEC), Reduction of Air Pollution from Existing Municipal Waste Incineration Plants (89/429/EEC) and Air Quality Standards for Nitrogen Dioxide (85/203/EEC).

The 1996 Ambient Air Quality Assessment Directive (96/62/EC) provides a new framework for controlling the most serious air polluting substances and ensuring that the European Commission and the Member States monitor and assess air quality in a consistent way.

In conclusion, it should be noted that the traditional approach of policies to reduce emissions of air pollutants has been through national programmes and regulations focusing on specific pollutants. However, in the last 20 years this approach has been criticized for not recognizing the cross-medium nature of environmental problems, resulting in pollution prevention actions that simply transfer the problem to another medium. Therefore, a move towards integrated pollution control has occurred in some European countries and the Integrated Pollution Prevention and Control (IPPC) EC directive will further advance this process.[2]

NOTES

1. First questionnaire: December 1995; second questionnaire: October 1996. See Editors' introduction.
2. See targets set at European level on TEPI Web page (http://e-m-a-i-l.nu/tepi//what's new/the documents/download example).