EXECUTIVE SUMMARY

2000 Review of Strategies and Policies for Air Pollution Abatement

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I. The Convention on Long-range Transboundary Air Pollution

The Convention on Long-range Transboundary Air Pollution was adopted in 1979, establishing a broad framework throughout European and North American regions covered by the United Nations Economic Commission for Europe (UNECE) for cooperative action on air pollution. The Convention is a landmark international agreement that coordinates efforts on research, monitoring and the development of emission reduction strategies on regional air pollution and its effects. It was the first international agreement to recognize both the environmental and human health problems caused by the flow of air pollution across political borders and the need for regional solutions. Forty-eight countries and the European Community are party to the Convention.

Parties to the 1979 Convention on Long-range Transboundary Air Pollution:

Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kazakhstan, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherlands, Norway, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, The former Yugoslav Republic of Macedonia, Turkey, Ukraine, United Kingdom, United States, Yugoslavia, European Community.

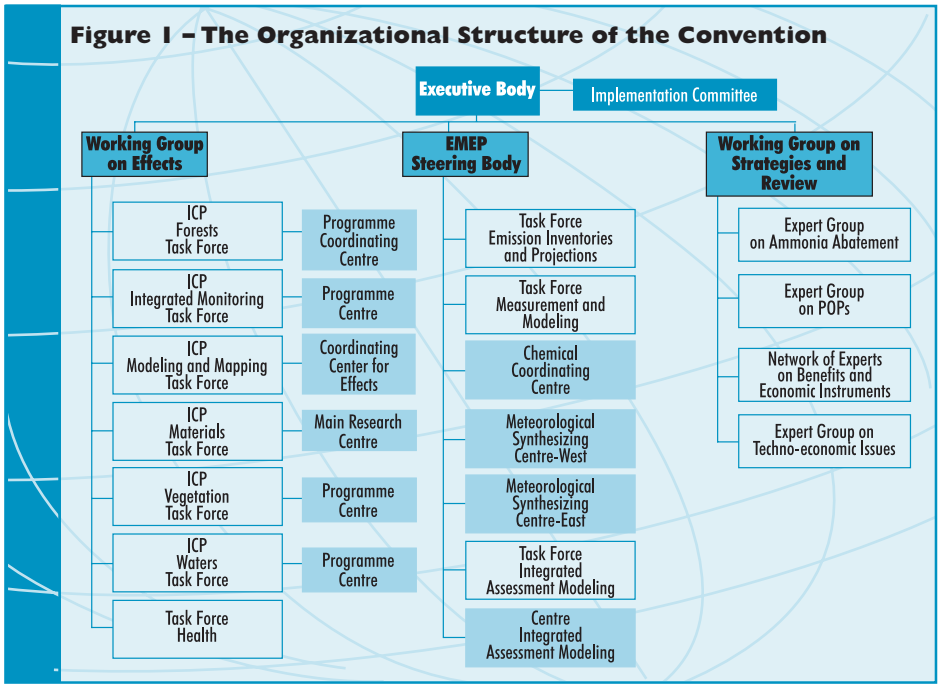
The Convention has set up a process for negotiating concrete measures to control specific pollutants through legally binding protocols. Since 1984, eight protocols have been adopted, five of which have entered into force. Those in force call for the reduction of emissions and transboundary fluxes of sulphur dioxide (SO_2 or "sulphur"), nitrogen oxides (NO_x) and volatile organic compounds (VOCs). The three recent protocols not in force call for control of emissions of heavy metals and persistent organic pollutants (POPs) and of ammonia (NH_3), NO_x, VOCs and sulphur that promote acidification, eutrophication and ground-level ozone. Besides ongoing cooperation under the Convention, several Parties are engaged in other multilateral or bilateral programmes for air pollution abatement within the UNECE region. The web site for the Convention provides more detailed information http://www.unece.org/env/lrtap.

II. Activities Within the Framework of the Convention

Wide ranges of skills and activities are necessary for Parties to achieve the Convention's objective to limit, gradually reduce and prevent long-range transboundary air pollution. The current structure of the Convention demonstrates this (figure 1). As a result of Convention activities, more than one thousand scientists and other experts are linked in an information network, greatly increasing information sharing. The Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) and the Convention's Working Group on Effects provide governments and subsidiary bodies under the Convention with qualified scientific information to support the evaluation and further development of the protocols negotiated under the Convention.

EMEP is comprised of four main elements: (a) collection of emission data; (b) measurements of air and precipitation quality; (c) modelling of atmospheric transport and deposition of air pollution; and (d) integrated assessment modelling. This review includes information on trends in emissions and the work that Parties are conducting with air pollution monitoring systems. For more detailed information on the work of EMEP, see http://www.emep.int.

Figure 1 – The Organizational Structure of the Convention



To develop the necessary international cooperation in the research on and the monitoring of pollutant effects, the Working Group on Effects (WGE) was established under the Convention. The Working Group on Effects provides information on the degree and geographic extent of the impacts on human health and the environment of major air pollutants, such as sulphur and nitrogen oxides, ozone and heavy metals. The Working Group on Effects manages six international cooperative programmes (ICPs) that study the effects of air pollution and their trends, for forests, waters, materials including cultural heritage, vegetation including crops, ecosystem monitoring and the mapping of critical loads and levels. There is also a joint task force, with the World Health Organization (WHO), that considers health effects of air pollution. For further information see http://www.unece.org/env/wge.

An Implementation Committee has been set up to evaluate compliance of Parties with their obligations under the Convention and its protocols. In addition, a number of expert groups, reporting to the Working Group on Strategies and Review, provide information on economic benefits and technical measures related to air pollution abatement.

III. 2000 Review of Strategies and Policies for Air Pollution Abatement

The information in this summary is derived in large part from replies to the 2000 Questionnaire on Strategies and Policies for Air Pollution Abatement circulated to Parties to the Convention. The purpose of the questionnaire was to develop an overview of air pollution abatement in the ECE region, as well as to provide a basis for reviewing the compliance of Parties with obligations under the protocols. The 2000 questionnaire was revised to reflect more directly these obligations. This was intended to aid the work of the Implementation Committee to assess the progress made by the Parties and the region as a whole and also to help Parties share information.

Parties were required to answer questions relating to their specific obligations to each protocol in force for them. The following 36 Parties to the Convention responded to the questionnaire, although their replies to individual questions on protocols were often dependent on whether they were Party to that protocol: Armenia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Republic of Moldova, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, The former Yugoslav Republic of Macedonia, Turkey, Ukraine, United Kingdom, United States and the European Community.

IV. Emission Levels and Trends

Under the Convention, the reporting of high-quality emission data is essential both in assessing the state of air pollution within the UNECE region and in establishing the compliance of the Parties with protocol commitments. At the end of each year, Parties submit to the UNECE secretariat their official emission data for sulphur, NO_x, NH_3, non-methane volatile organic compounds (NMVOC), carbon monoxide (CO), methane (CH_4), carbon dioxide (CO_2), heavy metals and POPs.

For this review, emission data are those submitted by Parties in 2000 for their 1998 emissions. Emission totals for the major air pollutants were reported by approximately 65% of the Parties to the Convention.[1/] The trends in SO_2, NO_x and NMVOC presented here show pollutants covered by the protocols in force. The projection year emissions have been omitted from the figures referenced in this section since the 1999 Gothenburg Protocol negotiations have concluded. The signatories to this Protocol will have revised emission estimates for 2010. The summary for 2002 will address these updated emission estimates.

European SO_2 emissions (fig. 2) show a clear downward trend. The total emissions of SO_2 in 1998 decreased by 56% compared to the 1980 level. The emissions of NO_x (fig. 3) are characterized by relatively high releases in the late 1980s and an easing-off in the 1990s. The NO_x reduction is 15% between 1980 and 1998. NMVOC emissions (fig. 4) refer to anthropogenic releases only. There is a downward trend in the 1990s, leading to a drop of 25% in VOC emissions in 1998 compared to 1980.

Emission trends estimates for SO_2, NO_x and VOCs for both the United States and Canada are shown in figures 5-7. In addition to the joint emission trends data, 1998 data on sources of emissions by sector are presented in figures 8-10.[2/]

1/ When official information is not available, estimates are given, based on information from available sources, in collaboration with the Chemical Coordinating Centre (CCC) and the International Institute for Applied Systems Analysis (IIASA). Where possible, figures reported under the CORINAIR Programme (1985, 1990 and 1994) substitute missing values. "Present State of Emission Data," EB.AIR/GE.1/2000/6, 11 July 2000.

2/ United States-Canada Air Quality Agreement, 2000 Progress Report.

Figure 2 – Emissions of Sulphur in the EMEP Area 1980-1998

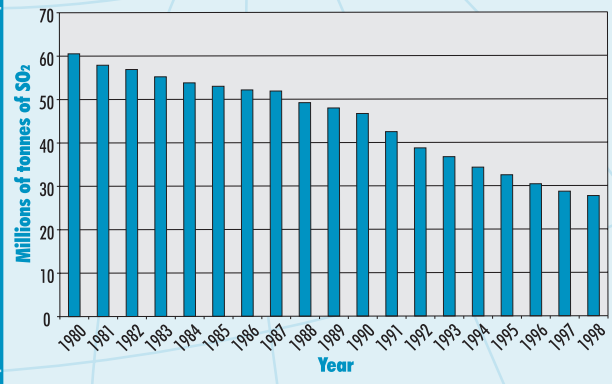


Figure 3 – Emissions of NO_x in the EMEP Area 1980-1998

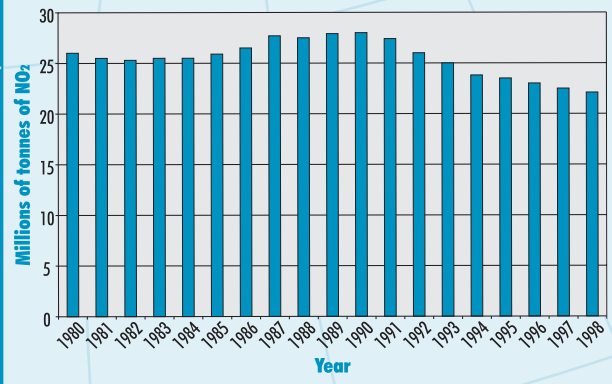


Figure 4 – Emissions of Non-methane Volatile Organic Compounds in the EMEP Area 1980-1998

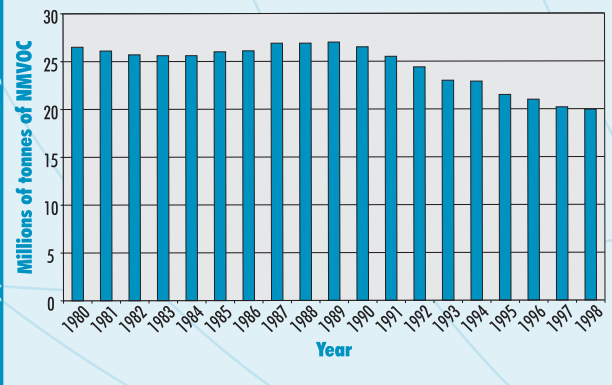


Figure 5 – North American Trends in Sulphur Emissions from 1980-1998

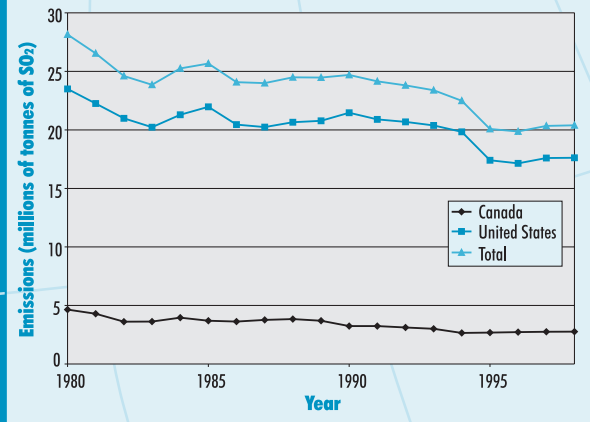


Figure 6 – North American Trends in NO_x Emissions from 1980-1998

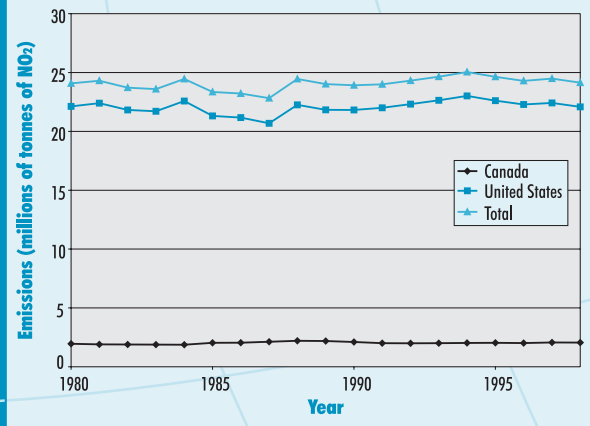


Figure 7 – North American Trends in NMVOC Emissions from 1990-1998

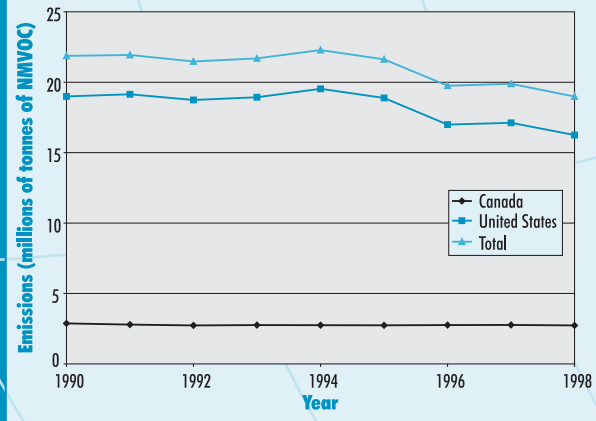


Figure 8 – 1998 Sector Emissions of SO_2 in North America

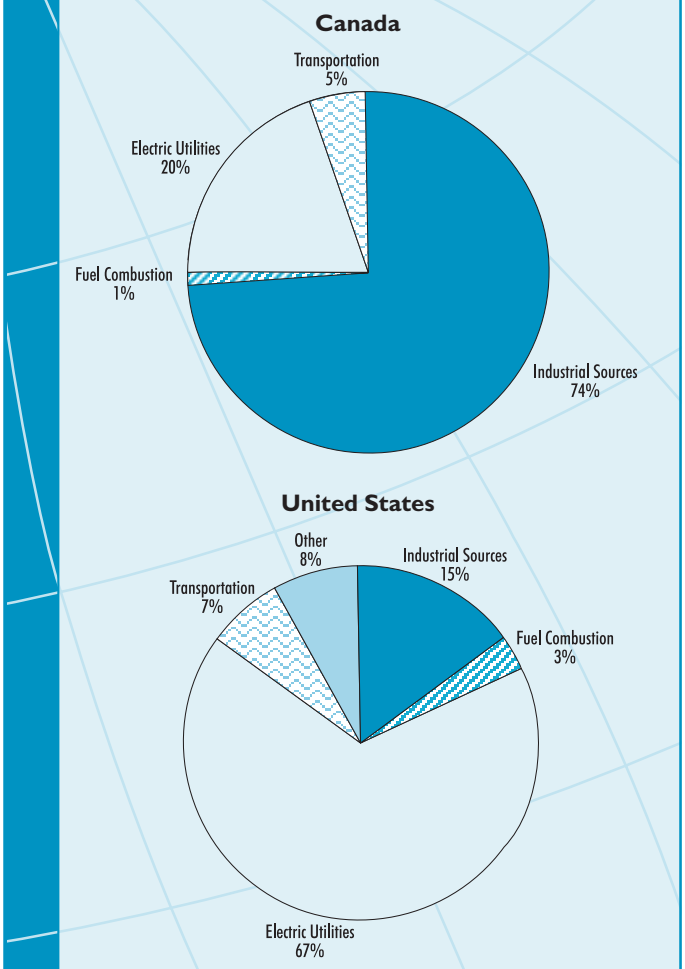


Figure 9 – 1998 Sector Emissions of NO_x in North America

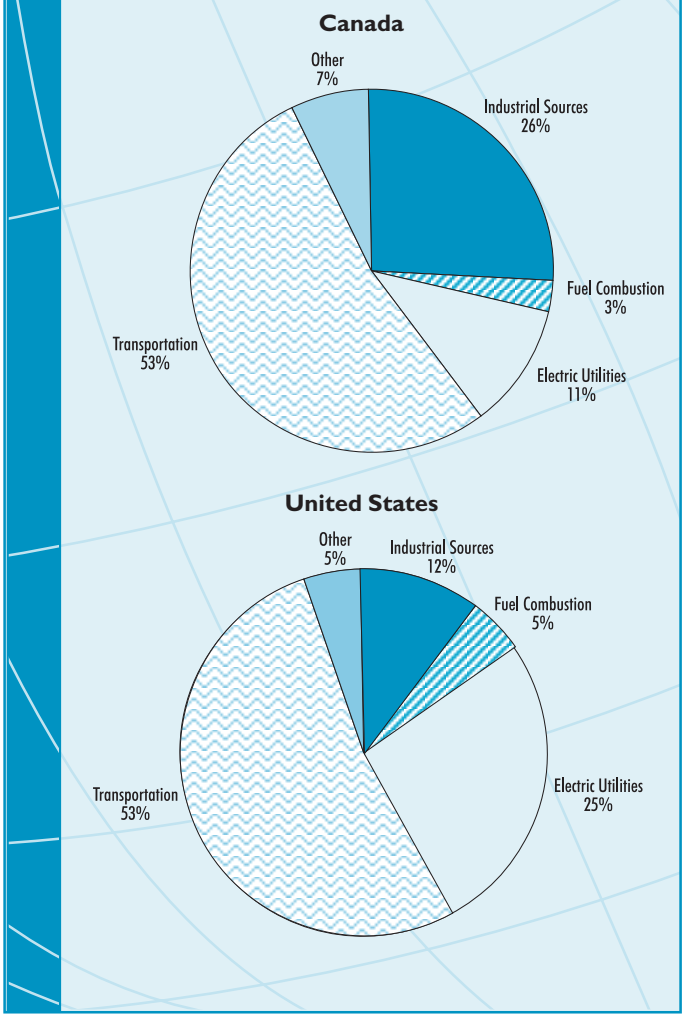
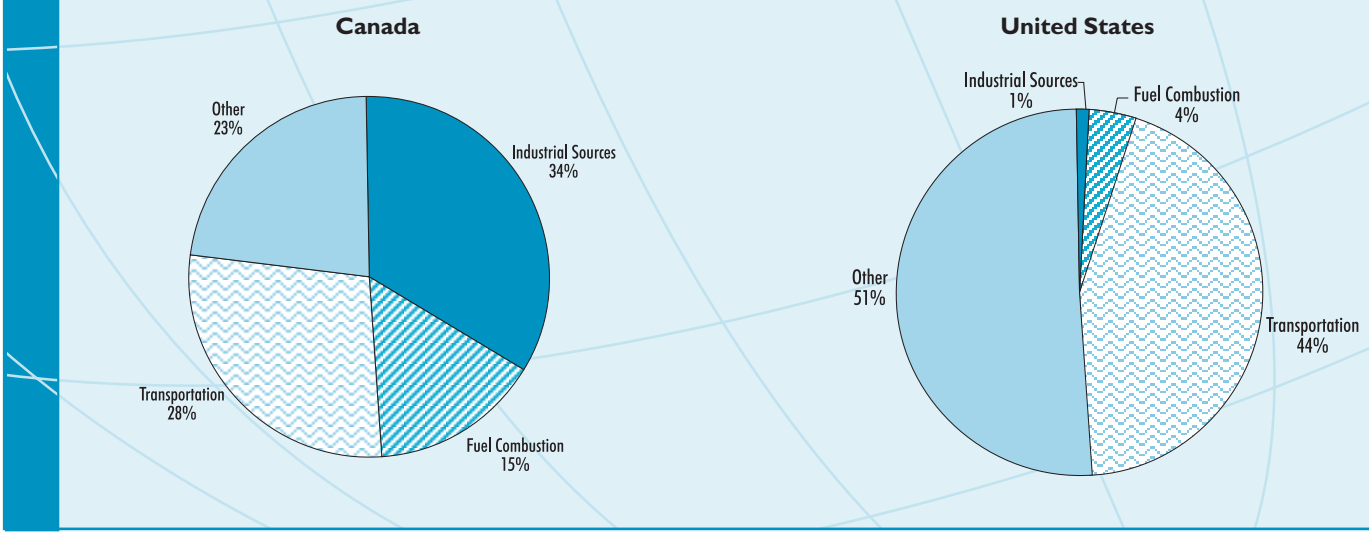


Figure 10 – 1998 Sector Emissions of VOC in North America



V. Monitoring and Research

Air pollution monitoring encompasses emissions, air quality, deposition and the environmental effects of air pollution. Monitoring may be designed to provide information for local problems, national issues, or for studies at the regional scale. EMEP prepares reports on monitoring data related to emissions, air quality and deposition and develops the science necessary to do its work in these areas. The Working Group on Effects is responsible for reporting on monitoring air pollution effects on the European scale and for developing the science to provide an understanding of the effects of air pollution and the processes of recovery. It also develops the methods for mapping critical loads and levels.

All Parties provided extensive information on their progress in research and monitoring in accordance with both the Protocols on NO_x and the Protocol on VOCs, though more Parties responded to the former. Research projects included technical economic studies, development, testing and implementation of predictive models, national inventories and national databases. These projects served to improve and update inventories, identify reduction and policy measures and establish human health and effects-based approaches. Atmospheric transport and receptor models are used to discover the fate of pollutants emitted to air and to identify indicators for the effects of pollution on ecosystems.

Monitoring sites are dispersed throughout most countries, though the numbers operated and the participation in the different monitoring programmes differ between Parties. The data collected are very important in assisting, for example, in calculating emission data and critical loads, estimating deposition levels, validating models and assessing effects and recovery.

VI. Description, Obligations and Implementation of the Basic Provisions for Reducing Emissions for the Protocols in Force

This chapter summarizes compliance and implementation for the four substantive protocols in force using officially submitted emission data, the 2000 questionnaire replies and earlier reviews under the Convention. More details are available through the Convention's web site (http://www.unece.org/env/lrtap). Further information on strategies and policies is summarized in chapter VIII.

A. 1985 Sulphur Protocol

22 Parties (as of 4 October 2002): 1/

Austria, Belarus, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Estonia[2/], Finland, France, Germany, Hungary, Italy, Liechtenstein[3/], Luxembourg[3/], Netherlands, Norway, Russian Federation, Slovakia, Sweden, Switzerland and Ukraine

1/ Information was received from the following Parties to the Convention that were not Parties to the Protocol at the time of distribution of the 2000 Questionnaire: Croatia, Poland and Republic of Moldova.

2/ Not a Party to the Protocol at the time of distribution of the 2000 Questionnaire.

3/ Did not reply to the 2000 Questionnaire.

The 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent, which entered into force in 1987, contains two requirements of Parties that remain of particular relevance. The first is to make a 30 per cent cut in emissions (or their transboundary fluxes) by 1993 from the levels recorded for 1980. For this, Parties develop national policies, strategies and programmes and report progress to the Executive Body. The second is to report sulphur emissions annually to the Executive Body.

According to official submissions, all of the 21 Parties that had ratified the Protocol prior to the 2000 Questionnaire (Austria, Belarus, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Liechtenstein, Luxembourg, Netherlands, Norway, Russian Federation, Slovakia, Sweden, Switzerland and Ukraine) made the required reductions by 1993 and have maintained these levels. One Party met its obligation in 1993, fell below the target in 1994 and 1995, but met it again from 1996 to 1998. For one Party, the Protocol entered into force in June 2000 but available data suggest its full compliance.

B. 1988 Protocol on Nitrogen Oxides

28 Parties (as of 4 October 2002): 1/

Austria, Belarus, Belgium[2/], Bulgaria, Canada, Czech Republic, Denmark, Estonia[2/], Finland, France, Germany, Greece, Hungary, Ireland, Italy, Liechtenstein[3/], Luxembourg[3/], Netherlands, Norway, Russian Federation, Slovakia, Spain, Sweden, Switzerland, Ukraine, United Kingdom, United States and European Community

1/ Information was received from the following Parties to the Convention that were not Parties to the Protocol at the time of distribution of the 2000 Questionnaire: Belgium, Georgia, Croatia, Latvia, Lithuania and Poland.

2/ Not a Party to the Protocol at the time of distribution of the 2000 Questionnaire.

3/ Did not reply to the 2000 Questionnaire.

The 1988 Sofia Protocol concerning the Control of Emissions of Nitrogen Oxides (NO_x) or their Transboundary Fluxes entered into force in 1991. It requires Parties to take effective measures to ensure NO_x emissions at the end of 1994 are not higher than those in 1987. In addition, six months after the Protocol's entry into force, its Parties must cooperate to establish critical loads and related emission reduction objectives with a timetable for action. Parties negotiate on further reductions, taking these into account. They should also facilitate the exchange of technology through direct industrial contacts, joint ventures, technical assistance and commercial exchange.

By 1993, Parties must apply national emission standards to all major source categories and new stationary and mobile sources using economically feasible best available techniques (BAT), while developing pollution control measures for existing stationary sources. Parties must also make unleaded fuel sufficiently available to encourage the use of vehicles with catalytic converters. Reporting requirements mirror those for the 1985 Sulphur Protocol.

Seventeen (Austria, Belarus, Bulgaria, Canada, Czech Republic, Denmark, Finland, France, Germany, Italy, Liechtenstein, Netherlands, Slovakia, Sweden, Switzerland, Ukraine and United Kingdom) of the 26 Parties that had ratified the Protocol prior to the 2000 Questionnaire met the target for each of the years 1994-1996, with four Parties meeting levels lower than target. Emission data reported for subsequent years show that 15 of the now 28 Parties saw consistent reductions in NO_x emissions between 1996 and 1998. Five Parties showed a consistent increase in NO_x emissions over the same period and three did not meet the targets for several years between 1994 and 1998. One Party expected to be back in compliance soon, while another is reassessing its base year emission estimates. Four Parties did not report their annual emissions so it was impossible to assess their compliance.

Figure 11 – Nitrogen Oxide Emission Reductions in the ECE Region as a Percentage of 1990 Levels (based on 1998 data)

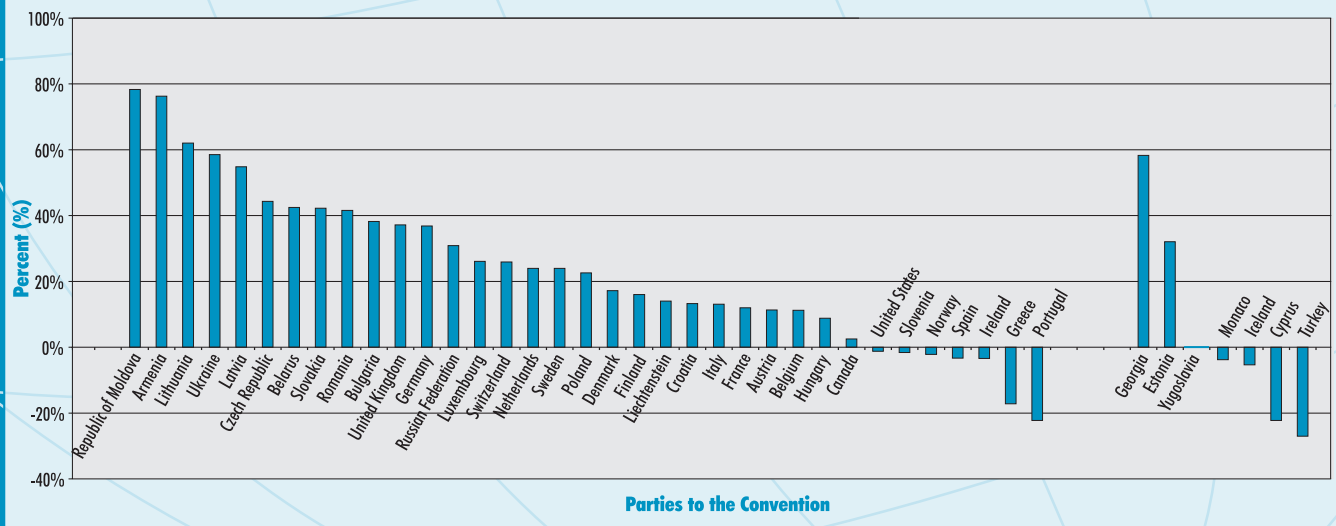
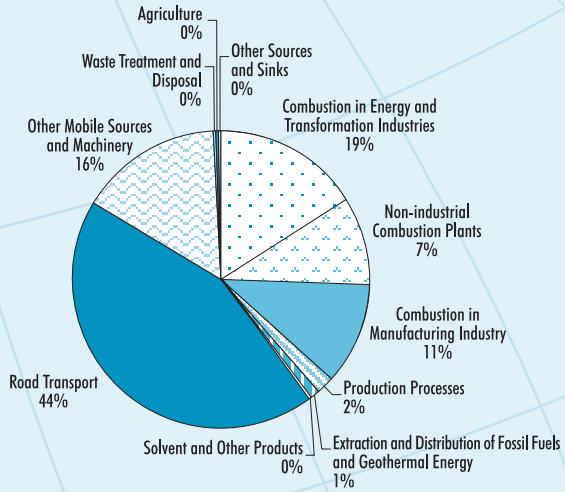


Figure 12 – 1998 Sector Emissions of NO_x in the ECE Region*



* Sectors with percentage contributions that appeared as 0% on the pie chart: Extraction and Distribution of Fossil Fuels and Geothermal Energy = 0.69%; Solvent and Other Product Use = 0.0004%; Waste Treatment and Disposal = 0.39%; Agriculture = 0.16%; Other Sources and Sinks = 0.05%

C. 1991 Protocol on VOCs

21 Parties (as of 4 October 2002): 1/

Austria, Belgium[2/], Bulgaria, Czech Republic, Denmark, Estonia[2/], Finland, France, Germany, Hungary, Italy, Liechtenstein[3/], Luxembourg[3/], Monaco[2/], Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland and United Kingdom

1/ Information was received from the following Parties to the Convention that were not Parties to the Protocol at the time of distribution of the 2000 Questionnaire: Belgium, Canada, Croatia, Georgia, Greece, Latvia, Lithuania, Poland, Ukraine, United States and the European Community.

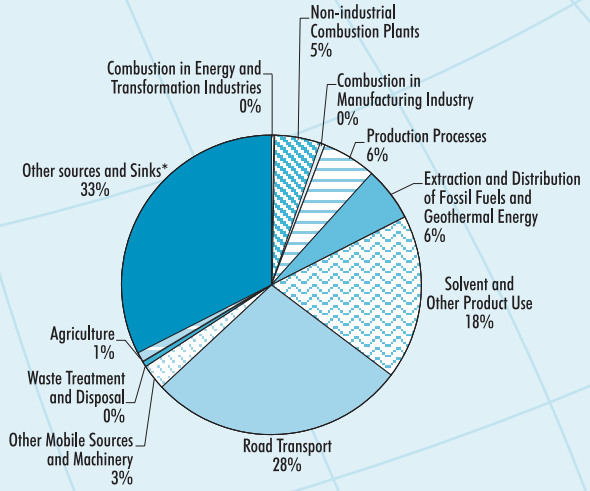
2/ Not a Party to the Protocol at the time of distribution of the 2000 Questionnaire.

3/ Did not reply to the 2000 Questionnaire.

The 1991 Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes entered into force in 1997. It requires Parties to reduce their VOC emissions by 30% by 1999 from the levels in 1984-1990. They should not exceed 1988 levels in tropospheric ozone management areas (TOMAs). Parties must apply national and international emission standards and measures to new stationary and mobile sources and products by 1999 and to existing sources by 2002. By 1999, Parties should foster public participation in national programmes through public announcement, traffic management and improved transport. By 2002, Parties need to apply economically feasible BAT and vehicle emission reduction techniques to any areas exceeding the standards. While taking the necessary measures to reduce VOCs, it is vital that all Parties ensure that carcinogenic and ozone-depleting VOCs are not substituted for those being replaced. Requirements for reporting progress mirror those for previous protocols.

Ten Parties (Austria, Bulgaria, Czech Republic, Denmark, Germany, Hungary, Luxembourg, Netherlands, Slovakia, Switzerland) of the 18 Parties that had ratified the Protocol prior to the 2000 Questionnaire have already achieved the target levels of the Protocol. Five additional Parties appear to be on course to do so in the coming years. Two Parties have achieved only a 6-7% reduction over the decade (1988-1998). One Party's emissions rose 39% at the national level and 26% for its TOMA. No projections were available for four Parties.

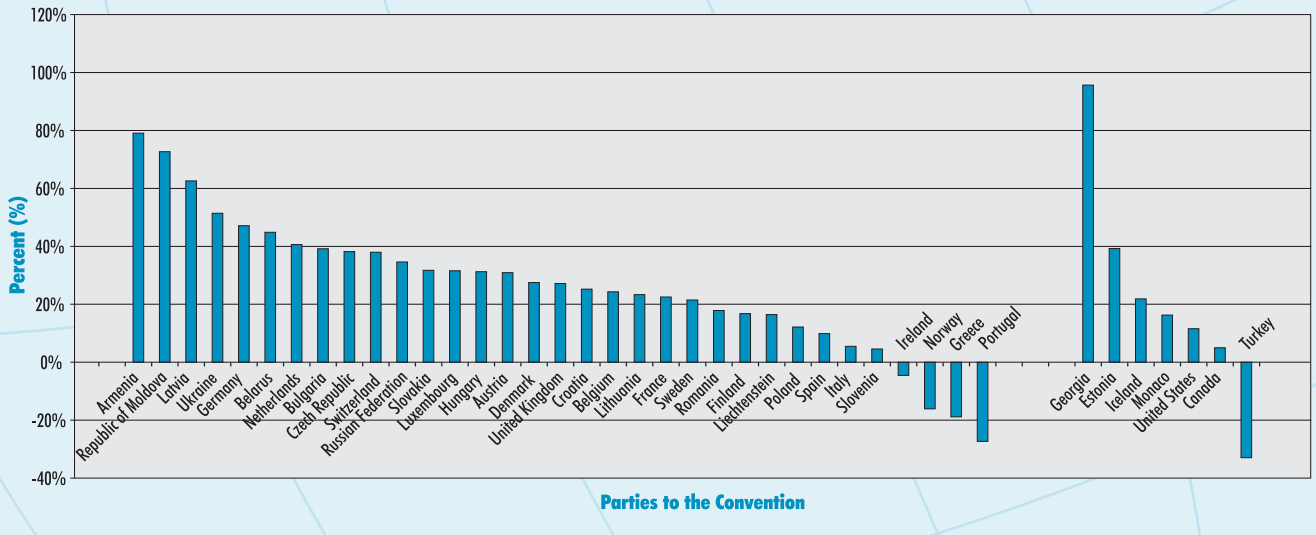
Figure 14 – 1998 Sector Emissions of NMVOC in the ECE Region**



* One country contributed significantly more than any other to "Other Sources and Sinks."

** Sectors with percentage contributions that appeared as 0% on the pie chart: Combustion in Energy and Transformation Industries = 0.35%; Waste Treatment and Disposal = 0.5%; Combustion in Manufacturing Industry = 0.5%

Figure 13 – Reduction in Emissions of Non-methane Volatile Organic Compounds in the ECE Region as a Percentage of 1990 Levels (based on 1998 data)



D. 1994 Sulphur Protocol

25 Parties (as of 4 October 2002):[1/]

Austria, Belgium[2/], Canada, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary[2/], Ireland, Italy, Liechtenstein[3/], Luxembourg[3/], Monaco[2/], Netherlands, Norway, Slovakia, Slovenia[3/], Spain, Sweden, Switzerland, United Kingdom and European Community.

1/ Information was received from the following Parties to the Convention that were not Parties to the Protocol at the time of distribution of the 2000 Questionnaire: Belgium, Bulgaria, Canada, Croatia, Georgia, Greece, Hungary, Latvia, Lithuania, Poland and the Russian Federation.

2/ Not a Party to the Protocol at the time of distribution of the 2000 Questionnaire.

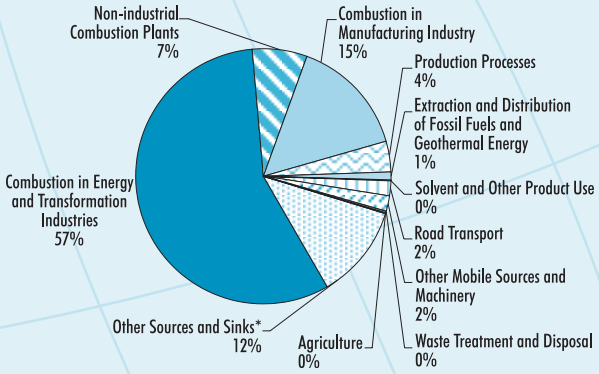
3/ Did not reply to the 2000 Questionnaire.

The 1994 Oslo Protocol on Further Reduction of Sulphur Emissions entered into force in 1998. It has more stringent requirements than those of the 1985 Sulphur Protocol; however, it does not supersede it since some Parties to the 1985 Protocol are not party to the Oslo Protocol. This, the second Sulphur Protocol, was the first to be genuinely effects-based and to allocate emission reductions to those countries where the overall benefit would be the greatest. The target reductions were therefore differentiated between countries.

The Protocol requires Parties to take the most effective measures to reduce emissions. It cites controlling the sulphur content of fuel, energy efficiency measures, the promotion of renewable energy and the application of BAT. This Protocol is the first requiring the mandatory application of emission limits, specified in the Protocol itself. There are mandatory limits on the sulphur content of gas oil. There is also a provision encouraging economic instruments for reducing SO_2 emissions cost-effectively.

There are two provisions for reporting requirements. The first is to report emissions of sulphur annually to the Executive Body as in the first Sulphur Protocol. The second part involves reporting on matters such as the application of emission measures and the implementation of strategies, which are dealt with through the 2000 questionnaire used to compile this summary. Seventeen Parties (Austria, Canada, Croatia, Czech Republic, Denmark, Finland, France, Germany, Italy, Luxembourg, Norway, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom) of the 22 Parties that had ratified the Protocol prior to the 2000 Questionnaire have already attained the emission reductions required while another three Parties appear to be on course to do so.

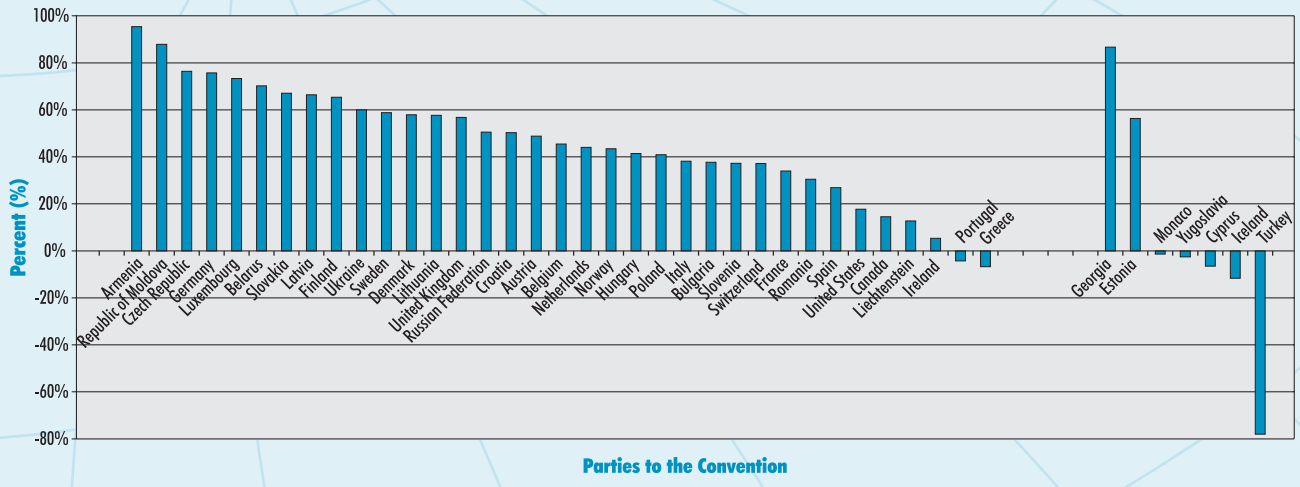
Figure 16 – 1998 Sector Emissions of Sulphur in the ECE Region**



* One country in the ECE region was primarily responsible for the 12% of emissions from "Other Sources and Sinks."

** Sectors with percentage contributions that appeared as 0% on the pie chart: Waste Treatment and Disposal = 0.2%; Solvent and Other Product Use = 0.031%; Agriculture = 0.011%

Figure 15 – Sulphur Emissions Reductions in the ECE Region as a Percentage of 1990 Levels (based on 1998 data)



VII. Description of New Protocols Not Yet in Force

A. 1998 Protocol on Heavy Metals

The 1998 Aarhus Protocol on Heavy Metals targets three particularly harmful metals, cadmium, lead and mercury, though it makes provision for adding other metals in the future if necessary. Parties will be required to reduce their emissions of the three metals below 1990 levels (or a chosen year between 1985 and 1995). The Protocol aims to cut emissions from industrial sources (iron and steel industry, non-ferrous metals industry), combustion processes (power generation, road transport) and waste incineration. It sets deadlines for applying emission limits to new and existing major stationary sources and suggests BAT, such as special filters, scrubbers or mercury-free processes, to achieve these limits. Alternatively, Parties may apply different strategies to achieve equivalent overall emission reductions.

The Protocol requires countries to phase out leaded petrol and introduce measures to lower emissions of mercury from products (such as mercury in batteries). It proposes the introduction of management measures for other mercury-containing products, such as: electrical components (thermostats, switches), measuring devices (thermometers, manometers, barometers), fluorescent lamps, dental amalgam, pesticides and paint.

In December 2000, the Executive Body noted the importance of the global-scale transport of mercury and invited the United Nations Environment Programme (UNEP) to initiate an assessment of mercury and consider future action. It indicated that it, together with its subsidiary bodies and in cooperation with its secretariat, was willing to help with the assessment process and make available its knowledge and expertise. The UNEP Governing Council has initiated the assessment. The Protocol on Heavy Metals will serve as a driving force for future global action in this area.

B. 1998 Protocol on Persistent Organic Pollutants

The 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs) aims to control, reduce or eliminate discharges, emissions and losses of POPs into the environment. There are 16 substances listed in the Protocol, 11 pesticides, 2 industrial chemicals and 3 by-products or contaminants. The Protocol bans the production and use of some products outright (aldrin, chlordane, chlordecone, dieldrin, endrin, hexabromobiphenyl, mirex and toxaphene). Others are scheduled for elimination at a later stage (DDT, heptachlor, hexaclorobenzene, PCBs). Finally, the Protocol severely restricts the use of DDT, HCH (including lindane) and PCBs. It sets deadlines for applying emission limits to new and existing major stationary sources and suggests BAT, such as special filters, scrubbers or mercury-free processes, to achieve these limits. Parties are permitted to apply, as an alternative, different strategies that achieve equivalent overall emission reductions.

The Protocol includes provisions for dealing with the wastes of products that will be banned. It also obliges Parties to reduce their emissions of dioxins, furans, PAHs and HCB below their levels in 1990 (or an alternative year between 1985 and 1995). For the incineration of municipal, hazardous and medical waste, it lays out specific limits. It calls on Parties, moreover, to promote the provision of information to the general public, including users of POPs, on labelling, risk assessment and hazard and risk reduction, as well as information to encourage the elimination of POPs or a reduction in their use. The Protocol allows for substances to be added or current obligations to be modified as new information is obtained.

Within six months of the Protocol's entry into force, its Parties must establish national policies, programmes and strategies to encourage the implementation of environmentally and economically efficient management and reduction techniques as well as re-evaluation. This must also take place for products that are contained as contaminants in other substances, chemical products or manufactured articles, as soon as the relevance of the source has been established. Within one year of the Protocol's entry into force, its Parties are required to review the feasibility of alternatives to DDT and promote their commercialization and within two years, they must re-evaluate all exceptions to restrictions on DDT, PCBs and HCH, including lindane.

Figure 17 – The POPs Protocol Controls Emissions of 16 POPs:

aldrin, chlordane, chlordecone, DDT, dieldrin, dioxins and furans, endrin, heptachlor, hexachlorobenzene, hexachlorocyclohexane (HCH), hexabromobyphenyl, mirex, PAHs, PCBs and toxaphene

The Protocol on POPs is seen as a major step towards global controls of these substances. It provided impetus for the negotiations on a global treaty on POPs. These were concluded in 2000 and a treaty was opened for signature in Stockholm in May 2001. This Convention will

require countries to reduce and/or eliminate the production, use and/or release of 12 POPs, consisting of nine pesticides (aldrin, dieldrin, endrin, DDT, mirex, chlordane, heptachlor, hexachlorobenzene also known as HCB and toxaphene), two industrial chemicals (PCBs and HCB; HCB has been intentionally produced for both pesticide and industrial chemical uses) and four unintentional by-product pollutants (dioxins, furans, PCBs and HCB; PCBs and HCB are listed as intentionally produced and unintentionally produced.) The treaty has provisions for adding other chemicals.

C. 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone

The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone is an innovative multi-effect, multi-pollutant protocol that will simultaneously address the three effects it describes through controlling the pollutants causing them. It promotes action within the UNECE region and sets an example for action worldwide.

The Protocol sets emission ceilings for 2010 for four pollutants: sulphur, NO_x, VOCs and ammonia. Ceilings were negotiated on the basis of scientific assessments of pollution effects and abatement options. Parties whose emissions have a more severe environmental or health impact and whose emission reductions are relatively inexpensive will have to make the biggest cuts. Once the Protocol is fully implemented, Europe's emissions should be cut significantly for sulphur (63%), NO_x (41%), VOCs (40%) and ammonia (17%), compared to 1990.

The Protocol also sets stringent limits for specific emission sources (e.g. combustion plant, electricity production, dry cleaning, cars and lorries) and requires BAT to keep emissions down. VOC emissions from products such as paints or aerosols will have to be cut and farmers will have to take specific measures to control ammonia emissions. Guidance documents adopted with the Protocol describe a wide range of abatement techniques and economic instruments to reduce emissions in the relevant sectors, including transport.

Estimates suggest that, once the Protocol is implemented in 2010, the area in Europe with excessive levels of acidification will shrink from 93 million hectares in 1990 to 15 million hectares and excessive levels of eutrophication will fall from 165 million to 108 million hectares. The number of days with excessive ozone levels will be halved. Consequently, it is estimated that life-years lost from the chronic effects of ozone exposure will be about 2,300,000 fewer in 2010 than in 1990 and that each year there will be about 47,500 fewer premature deaths resulting from ozone and particulate matter in the air. The area of vegetation exposed to excessive ozone levels is expected to be 44% smaller.

VIII. Progress and Implementation of National Policies and Strategies

Many Parties have a legislative framework that forms the basis for environmental regulations in general or for air pollution abatement in particular. For others, the legislative framework is made up of a host of regulations, decrees or directives, sometimes extending to the regional, provincial or urban level. A few have constitutional laws in place and many (in particular European Community (EC) Member States and applicant countries) refer to EC directives. Such laws include control and management acts and may incorporate such concepts as the "precautionary" and "polluter pays" principles, while recognizing regional differences and priorities. Most commonly, Parties establish emission standards and emission limit values (ELVs) based on best available techniques (BAT); require emission data reporting according to these standards; set fuel standards; and use public health criteria to determine concentration limits and regulate the international trade in hazardous substances.

Generally, Parties have developed action plans for long-term programmes to implement their strategies. Some Parties have specified objectives for air pollution abatement policies on the basis of the effects of those pollutants, while others base their air pollution abatement policy on BAT (or BAT not entailing excessive cost). Some Parties set emission reduction targets based on Protocol obligations or domestic policy, whilst others set goals and requirements for achieving national air quality standards. A mix of instruments is used in most cases, though the different types of measures should be complementary.

Air quality standards or target levels are regulatory measures that frequently serve as a reference for other standards (e.g. fuel quality, control technology) designed to achieve a desired level of air quality. Target loads or deposition standards, often established after consideration

of critical loads, play a similar role by providing a basis for other policy measures. Air quality standards, target loads or deposition standards may also be important indicators for determining whether a Party is meeting its air quality goals. However, these are not obligations under the protocols and information on these have not been specifically requested from Parties.

EC directives are a set of provisions established by the Economic Council of the European Union. Many EC Member States meeting these provisions draw attention to this rather than provide detailed information. The Basel Convention is a treaty concerning the transboundary movement and disposal of hazardous wastes. For heavy metals and many POPs, several Parties have reported that they are implementing this treaty but provide no further information. The summaries below do not reflect information on either EC directives or the Basel Convention.

Parties reported their national strategies, policies and programmes that specifically address the control and reduction of the relevant pollutant or pollutants and their transboundary fluxes. The information is summarized below for each main area of reporting, but with detailed information for each protocol. Information on the 1998 Protocols on Heavy Metals and POPs was provided at the option of each country, as these protocols were not yet in force at the time the 2000 questionnaire was distributed. In addition, while negotiations on the Gothenburg protocol have been completed, the 2000 questionnaire did not include questions regarding this protocol.

A. Fuel Quality Standards

The sulphur content in fuel is a major element for emission control policies in the UNECE region. Most Parties now regulate this. The maximum permissible content is generally specified separately for heavy, medium, light and extra-light fuel oil, as well as for gas, oil, coke and coal. In a few countries, fuel quality standards are uniformly applied nationwide. Alternatively, countries are more stringent in large urban areas and in sensitive regions than in other areas. Parties have given special attention to standards controlling the lead content of petrol.

1985 Sulphur Protocol

Countries indicated the use of the following methods to decrease their sulphur emissions: establishing emission limits and taxes for the sulphur content of fuels; converting industrial, utility and domestic sources from coal and fuel oil to natural gas; and converting mobile sources to compressed and liquefied natural gas fuels. Some Parties reported that they focused on the desulphurization of fuel oil.

1988 NO_x Protocol

For national strategies and policies, no fuel quality measures were reported. Fifteen Parties to the Protocol had banned or phased out leaded fuel. The remainder identified dates for its phase-out, though two still market more leaded than unleaded petrol. Dates for phasing out unleaded petrol range from January 2001 to 2005, with the majority of Parties aiming for December 2004 to 2005. EC directives allowed EC Member States to market leaded fuel until December 2001.

1991 VOC Protocol

Most countries reported their national strategies and policies; two specifically mentioned their requirements for classifying fuels. Most also described reductions in VOCs in relation to the distribution, refuelling and volatility of fuel, while five reported reducing the volatility of fuels by offering unleaded petrol, reducing vapour pressure for fuels and setting limits for harmful substances in fuel, such as benzene. Some countries gave information on reducing emissions from refuelling and one provided information on distribution and storage. The methods used include restrictions on the loading, unloading and transport of liquid mineral oil products. Modifications in equipping and operating petrol stations, such as installing different pump nozzles, were also mentioned. Some countries referred to an EC directive.

1994 Sulphur Protocol

Primarily, countries focus on flue gas desulphurization and switching from solid fuels to gas- or oil-fired systems for industrial and domestic use. When identifying national standards for the sulphur content of gas oil, countries mainly give the standard they have for sulphur content. Some countries indicated measures to address sulphur in oil products, while two noted the use of a sulphur tax to encourage light and desulphurized fuels.

1998 Protocol on Heavy Metals

There was a focus on leaded fuel, with some Signatories reporting on progress made in their phase-out, as discussed for the NO_x Protocol.

1998 Protocol on POPs

One country referred to fuel standards, noting structural changes in its fuel consumption.

B. Emission Standards and Emission Limit Values

Standards for the control of air pollutants either set maximum permissible quantities for specific sources and for specified pollutants, or require specific technological controls to be applied. Emission standards can be set industry by industry, plant by plant or on the basis of national emission standards for specific pollutants.

1985 Sulphur Protocol

Some countries reported the use of ELVs for various sources, fuels and technologies, including major stationary sources, such as large combustion plants.

1988 NO_x Protocol

A few countries reported using ELVs for existing or new installations, such as combustion plants or waste incinerators, to reduce emissions, while most Parties noted emission standards, generally applying limits to new and existing stationary sources. Some based standards on BAT and used them for licensing procedures. Most Parties also reported applying emission standards to new mobile sources, while a few identified using ELVs for control measures for stationary sources.

1991 VOC Protocol

Two Parties reported applying individual ELVs for VOCs discharged from industrial stationary sources. For emission standards for new sources, reports indicated several countries applying ELVs to stationary sources, such as new incineration plants; two applied ELVs to mobile sources and four used ELVs based on BAT for fuel vapour emissions or surface coatings. For existing stationary sources, a few countries expected to have new ELVs and emission standards in the next year. For emission standards for new mobile sources, most countries drew attention to their actions for the NOx Protocol. One country reported using ELVs to limit the consumption of products containing solvents. Most countries referred to EC directives for establishing ELVs.

1994 Sulphur Protocol

The second Sulphur Protocol was the first to require the mandatory application of ELVs. A few countries reported the general use of ELVs for controlling emissions from new sources. Three based ELVs on BAT, while two used ELVs for pollution permits. For existing sources, three countries reported basing ELVs on BAT and two used ELVs for the licensing of plants.

1998 Protocol on Heavy Metals

Countries reported the general use of ELVs for controlling emissions from heavy metal production, use of leaded fuel and particulate matter. Many had implemented some ELVs for existing stationary sources. One country based ELVs on BAT, one used them for licenced sources and one applied them to sources that had obtained a permit. These ELVs are primarily based on sector specific information, dealing with method and type of production. Two Signatories reported using ELVs as part of their product control measures.

1998 Protocol on POPs

One country reported using ELVs for regulating the disposal of certain POPs. In applying BAT for the reduction of POPs, several Signatories applied ELVs. One Signatory applied ELVs for licensing a stationary source.

C. Licensing and Permitting of Potentially Polluting Activities

A common regulatory procedure among Parties is for a government to authorize the initial operation of potential sources of air pollution and to impose specific environmental requirements on their continuous operation.

1985 Sulphur Protocol

A few countries reported using permit systems, while one applied a licensing restriction to new sources. One country is working on strategies to decrease the sulphur allowances of their permits. Pollution control permits may be based on emission ceilings set by EC directives.

1988 NO_x Protocol

A small number of countries reported national strategies for using permit systems. They used permits for establishing standards, conditions and ELVs for stationary sources. Two countries licenced stationary sources when establishing emission standards. For other major existing stationary sources, some countries used permits and licences. Parties determined the terms of a permit on a plant-by-plant basis, or by basing it on the previous permit given to that source. Some permits were given only if the source applied BAT,

while others were used to define BAT for a source. The licences may also be used for defining ELVs. For new mobile sources, one country reported a licensing procedure dependent on the vehicle type.

1991 VOC Protocol

For new sources, a few countries reported using pollution permit and licensing procedures. One applied the procedure automatically for each new installation. Two Parties used pollution permits for existing stationary sources. For new mobile sources using BAT, most countries referred to action under the NOx Protocol. Criteria for permits could be based on fuel volatility or the evaporation of organic substances.

1994 Sulphur Protocol

A few countries reported using licensing and permitting procedures in national strategies and policies for reducing SO_2. Permits were sometimes used to design the policies for decreasing emissions. Usually new or modified boilers required a licence. For new and existing sources, a few other countries used licences and permits primarily as a requirement for BAT in large stationary sources. Two more had a licensing system to set ELVs for existing stationary sources provided BAT was applied.

1998 Protocol on Heavy Metals

Two countries reported using permit and licensing systems as part of their national strategies for controlling potentially harmful operations. Permits help regulate emissions of heavy metals and contain conditions for industrial standards and ELVs. A few Signatories set BAT and ELVs for existing stationary sources; permits were needed prior to the construction of a plant. Certain countries also included environmentally sustainable technologies, such as electrostatic precipitators and scrubbers, in their permits.

1998 Protocol on POPs

One country was applying, as part of its national strategies and policies, environmental permits to all activities falling under the Protocol. When ensuring that destruction and disposal of substances were done in an environmentally sound manner, two Signatories required a licence or permit for receiving and managing hazardous waste, while one made generators of hazardous waste obtain a permit. Concerning transboundary movement, one country issued licences for the import and export of hazardous substances.

D. Product Regulation

Controlling the use and production of certain substances is often used to reduce the harmful effects of pollutants. Regulating the characteristics of products can also be effective under certain circumstances. Application of measures to reduce emissions from products is required by Parties to the 1991 VOC Protocol.

1985 Sulphur Protocol

The only product regulation reported was that previously mentioned in reference to fuel standards. One Party encouraged the production of extra-light heating oil.

1988 NOx Protocol

Only measures to increase the production of unleaded fuel were noted.

1991 VOC Protocol

Parties noted that the products receiving special attention in relation to product regulation measures are coatings, paints, lacquers and inks. Most Parties also indicated that carcinogenic and ozone-depleting VOCs were not being substituted for those being replaced and elaborated on their national legislation or regulations. Many Parties referred to the Montreal Protocol, which addresses the substitution of VOCs harmful to the stratospheric ozone layer. In most countries, chemicals classified as carcinogenic or poisonous are not sold to private consumers.

1994 Sulphur Protocol

Parties have drawn attention to the desulphurization of oils and efforts to promote unleaded fuel, but no specific product regulations are required under the Protocol.

1998 Protocol on Heavy Metals

Some countries reported product regulations, either mandatory or recommended, that were part of their national strategies, e.g. phasing out leaded petrol, reducing mercury emissions from chlorine production and decreasing the use of cadmium in regulated products. A number of Signatories noted specific product management measures: batteries containing mercury, lead, cadmium, zinc, carbon and alkaline manganese; four types of lamps containing mercury; fluorescent tubes containing mercury; dental amalgam waste containing mercury; anti-fouling agents; paints; pesticides; and plastics. One country reported on its product charges and deposit fees.

1998 Protocol on POPs

Because of the serious toxicity of POPs, the Protocol's obligations relate to controlling production and to the use of products that contain POPs. Countries reported on regulating substances listed in annexes I and II to the Protocol. Many Signatories reported eliminating the production and use of annex I substances and restricting annex II substances. Many also banned or prohibited the sale and production of most substances in annexes I and II. Signatories are taking measures to ensure the destruction or disposal of annex I substances in an environmentally sound manner, e.g. developing waste management infrastructure, waste collection separation systems, waste recycling, waste minimization, cleaning up landfills and treating waste biologically. Countries reported measures in place to ensure the disposal of annex I substances domestically. Under special circumstances, waste was exported. Several Signatories took measures to ensure that the transboundary movement of substances was done in an environmentally sound manner. Several also had strategies to identify material still in use and waste containing the substances in the annexes . This included the labelling of products or equipment. Many countries referred to the provisions of the Basel Convention.

E. Measures Related to Emission Control Technology

A common approach to ensuring that appropriate control technology is applied is to require the use of BAT, "state-of-the-art" technology or "best practicable means". In some countries, these concepts are explicitly stated in environmental legislation, whereas others stipulate their use in the permits and licences for undertaking potentially polluting activities.

1985 Sulphur Protocol

One country identified its national strategy as using BAT to address the sulphur content in fuels.

1988 NOx Protocol

BAT was a major focus for the strategies and policies of three Parties for controlling new and existing stationary sources, determining ELVs and licensing procedures. Regarding emission standards for all sources and control measures for existing stationary sources, a few countries referred to BAT and reported its use to determine ELVs and licence requirements. Three countries had drafted BAT documents and were cooperating with other countries to define BAT for the exchange of technology.

1991 VOC Protocol

For national strategies and policies, three countries used BAT to establish ELVs and to improve new and existing sources. Many used BAT to set standards for new mobile sources, while a few set standards for new sources by applying BAT, or making BAT a basic requirement for obtaining a licence. One country noted control measures for existing stationary sources through issuing BAT standards in air pollution regulations. Another used BAT to introduce techniques for cutting emissions from petrol distribution. Two countries were exchanging information on BAT in multilateral efforts, while one also applied BAT to stationary sources to avoid replacing VOCs with carcinogenic ones.

1994 Sulphur Protocol

Two countries authorized licences for industrial processes based on BAT as a main focus for strategies and policies. For new and existing sources, several countries applied BAT and two specifically identified BAT for determining licence and permit requirements. For new stationary combustion sources, three more countries based their plant standards and permit requirements on BAT. For existing stationary combustion sources of specified thermal input, four countries applied ELVs through the operators' use of BAT. No use of BAT was reported for reducing the sulphur content of fuels. A few countries used BAT in the exchange of technology both for applying BAT to the process of transferring information and for developing information centres for BAT research.

1998 Protocol on Heavy Metals

One country reported applying BAT for monitoring as an overall mechanism for reducing emissions. Many Signatories identified BAT for existing stationary sources as a means of controlling emissions from metal production, setting ELVs and permit and licence requirements. One used state-of-the-art BAT to set ELVs for existing stationary sources. For the exchange of technology, three Signatories applied BAT to information transfer, another shared its information on BAT and exchanged its BAT information to encourage and develop monitoring.

1998 Protocol on POPs

For national strategies and policies, one country introduced BAT for all 12 POPs. Several Signatories noted their use of BAT to set ELVs or for licences. Two countries applied BAT to the exchange of technology.

F. Stationary Sources and Mobile Sources

1985 Sulphur Protocol

Parties were not required to report specifically on the types of sources, though information on fuel and oil products and stationary sources was given, e.g. large combustion plants, boiler plants, coal-fired plants, heating pyrites that produce sulphuric acid and sulphuric acid production for non-ferrous metals. Methods used to cut sulphur emissions included converting large thermal power stations to gas and converting industrial utility and domestic energy sources from coal and fuel oil to gas. In addition, countries installed dual-catalyst installations for sulphuric acid production, decreased solid fuel use and improved the desulphurization of fuel.

1988 NO_x Protocol

All countries reported progress in applying national emissions standards to major new stationary sources and to new mobile sources and in the introduction of pollution control measures to major existing stationary sources. Several identified control and regulation of both stationary and mobile sources as a primary focus of their national policies and strategies. Regarding the extent of emission standards used, many Parties referred to stationary plant, some new and some existing. For the emission standards for new mobile sources, Parties often based limits on the size of the vehicle and the type of fuel used. New mobile sources of NO_x included passenger cars, heavy-and light-duty vehicles, road and non-road vehicles, motorcycles and mobile equipment, as well as action associated with road transport, such as vehicle refuelling. Some devices listed for maintaining standards were: new catalytic converters, stricter motor vehicle standards, improved vehicle inspection maintenance programmes, better road traffic laws and reformulated petrol. For control measures for existing stationary sources, many Parties reported basing them on process- and site-specific information and listed the following: coal and oil-fired electric utility boilers, nitric acid production plants, construction materials production, glass and cement industries, limestone burning, bauxite rotary kilns and stationary diesel fuel engines. Control measures used were: flue gas recycling, installing catalytic processes, emission caps, steam gas turbines, wind power units and small hydropower plants.

1991 VOC Protocol

National strategies and policies have been applied to stationary and/or mobile sources. Reports of emission standards for new sources by 22 countries revealed that stationary sources are regulated through fuel volatility and the evaporation of organic substances. The new sources listed were solvents, organic products and paints and other coatings. Methods for limiting emissions from these included: vapour recovery systems, regulations for cleaner petrol loading, coating regulations and establishing limit values for VOC emissions. Countries provided information on the following existing stationary sources: petroleum, oil refineries and production of dyes, lacquers and pharmaceuticals. For new mobile sources, they mostly referred to their actions reported for road and non-road sources related to the NO_x Protocol.

1994 Sulphur Protocol

Some countries reported national strategies for stationary sources, with one mentioning mobile sources as well. Restrictions mainly applied to the industrial sector. Many countries used measures to reduce emissions from new and existing sources; most identified their stationary sources, while the main mobile source was shipping. Many countries were decreasing the levels of sulphur in gas oil, road diesel, railway diesel and petrol. For stationary sources, such as large combustion plants, electric power generators, private and industrial heating systems, processors using coal and coke, boilers, furnaces and hazardous waste incinerators, the methods being applied included: converting power stations to natural gas; converting industrial and private heating systems from solid fuel to gas or oil; switching homes to geothermal water heating; using wind power; combining heat and power systems; designing hydroelectric stations; increasing the insulation of buildings; initiating acidification and smog plans; increasing the efficiency and modernization of stationary sources; and enhancing fuel desulphurization technologies. For new stationary sources, the same approaches were used, though they are often evaluated according to fuel type and thermal capacity. The major efforts being made to decrease sulphur emissions are improving energy efficiency and using renewable energy sources.

1998 Protocol on Heavy Metals

Most countries were making efforts to reduce emissions of heavy metals from stationary sources and mobile sources. Several reported applying BAT and ELVs to existing stationary sources. These were mainly based on sector-specific information and measurement of total suspended particles. Sources identified were: chlorine production using mercury cathodes for electrolysis, steel and iron production, plant using fuel combustion processes, waste incineration,

transport, lead and silver ore treatment, chemical industries, blast and electric arc furnaces and glass, cement and construction material production. Some countries also promoted the recycling, treatment and decrease of hazardous wastes to prevent emissions of metals.

1998 Protocol on POPs

Most countries reported that their methods for reducing POPs included monitoring soil and water. A few were focusing on stationary sources and two on mobile sources. Though not asked to report on specific sources, some countries identified household waste incinerators and hazardous waste incinerators as their only stationary sources.

G. Exchange of Technology

Parties provided numerous examples of measures taken to facilitate the exchange of technology, e.g. internet-accessible information, disseminating government publications on the exchange of technology, establishing foreign business partners, sharing BAT information, establishing trust funds and international financing organizations, developing professional associations, convening meetings/conferences on technology, publishing journals, promoting activities such as "Earth Day," capacity building and implementing and sharing environmental performance reviews (EPRs).

For the 1991 VOC Protocol, Parties identified the following mechanisms to foster public participation in emission control programmes: public information campaigns such as "Car-free Cities" day; facility inspection clinics; information bulletins; providing public access to environmental impact statements; subsidies to civic organizations; subsidies for public transport; and public announcements reporting the daily ozone level.

H. Critical Loads

A "critical load" means a quantitative estimate of the exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur, according to present knowledge. Parties were required to report on critical loads under the 1988 NOx Protocol and the 1994 Sulphur Protocol; they will be required to do so under the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone as soon as it is in force. Most indicated they had made progress in establishing critical loads and had provided the ICP Modelling and Mapping of the Working Group on Effects with critical load data for acidity and eutrophication. Data had been submitted over 1985-2000.

I. Economic Instruments

The major economic instruments used to improve air quality and the environment by Parties were: regulatory taxes in favour of the environment; excise customs and duty on traded goods of concern; energy prices set or influenced by the government; fees on pollution discharge; product charges for harmful or hazardous materials; and major penalties for exceeding regulatory limits. Motor vehicle taxes were often applied, depending on engine size, vehicle weight, power, fitting of catalytic converter and fuel consumption. Many Parties, moreover, have a sulphur tax to promote low-sulphur diesel fuel. In many cases, tariffs for imported goods apply to fuel and cars (especially imported older cars), while alternative fuels are not subject to such a tax. Exceptions are often reported in the case of mineral oil for uses other than fuel, for aircraft or ships, blast furnaces and for agriculture. In many areas, retail prices are set in favour of unleaded petrol. Fees for pollution discharge range from specified road tolls for heavier vehicles to businesses paying a monthly or quarterly charge. Product charges are commonly applied to fuels, tyres, batteries, refrigerators, fuel oil and lubricants.

On market incentives, most Parties reported on large-scale environmental programmes, including voluntary labelling schemes and national emissions trading for sulphur and NOx. The latter refers to tradable allowances for emissions that can be bought and sold by industries, encouraging operators to emit less. Many Parties will first cap emissions and allow trading under the cap, introduce environmental quotas and establish emission limits for all plants.

Parties often earmarked revenues from their economic instruments, e.g. to compensate those suffering damage from pollution, to subsidize emission control measures or to compensate for a loss in competitiveness. Several Parties drew attention to their national and regional environmental funds, which mostly provided interest-free loans, financed investment in environmentally sound technology, funded monitoring programmes, provided income for municipalities and established national environmental programmes. A few Parties also used revenues in energy-saving schemes, public transport and tax refunds for recycled goods.

Regarding the use of financial assistance schemes to reduce emissions, many Parties applied national incentives to, for example, construction and rehabilitation of cities and residential areas, solar power and energy efficiency. Government subsidies are a very common method of

financial assistance and were used for agriculture (to increase organic farming and discourage pesticide use), environmental education, health and research and monitoring. Parties also made use of loans and grants, waved fines for companies investing in pollution abatement technology, initiated programmes for businesses to apply for support in energy reduction projects and allowed tax deductions for research and development programmes for new pollution prevention technologies.

Parties sometimes used subsidies that resulted in detrimental effects on the environment. In a few countries, because of certain domestic political pressures, these subsidies were given priority over environmental goals, e.g. subsidies for aviation resulting in increased emissions, or where there were divergent interests, e.g. decreasing public transport funds because of lowering income taxes, resulting in increased commuter numbers.

J. Voluntary Measures and Agreements

Parties sometimes used voluntary measures and agreements to further reduce air pollution. Examples of such efforts included: promoting electricity from renewable sources; programmes to improve petrol; decreasing the use and impact of solvents (such as detergents); pollution prevention and cleaner engine initiatives (such as hybrid and gas-powered vehicles); eco-labelling; packaging for re-use; introducing catalytic converters; incentives for using public transport; and providing assistance with training, advice and organization in cleaner production.

K. Integrating Policies

The Integration of decision-making in some key policy areas, such as transport, energy, trade and the economy, can be considered as preventive measures that complement end-of-pipe controls. Many countries had implemented national policies promoting air quality improvements through sustainable development, economics and farming. Several Parties also targeted energy and transport policies, including renewable energy projects, encouraging modal shifts from road to rail and cooperation between public and private transport services. A few Parties set their policies towards fulfilling international obligations, such as commitments to protocols. Many countries have integrated production and development with schemes such as EPRs and environmental impact assessments (EIAs). Where required, these monitor progress, establish environmental obligations and guidelines and promote environmentally sound economic reform. Countries also created environmental councils to advise and enforce policies.

L. Future Review of Protocols, Priorities and Research

A major priority of the Convention at present is the implementation and compliance with existing agreements. The Convention's Working Group on Strategies and Review is considering plans for reviewing the protocols that enter into force, which may lead to recommendations for revising Parties' obligations to these protocols. The Executive Body is responsible for making decisions regarding the details of the reviews. However, the Protocol on POPs specifies that a review should be completed within three years of its entry into force, while the Gothenburg Protocol indicates a review should begin within 12 months of entry into force. Discussions are already under way on the nature and content of the reviews and scientific work has begun in the three core scientific areas: atmospheric measurement and modelling, effects and integrated assessment, including modelling and economic benefit evaluation.

The Convention is increasing its emphasis on new issues not covered directly by existing protocols, such as health impacts and particulate matter. It is also becoming concerned with the potential transport of pollutants beyond the continental scale. Recently, the Protocol on POPs was extended to the global scale through the 2001 Stockholm Convention. The Executive Body is now expected to consider how to improve the scientific understanding of the movement and impacts of ozone and fine particulates, which may be transported around the northern hemisphere. These pollutants not only cause human health and environmental damage, but are also important greenhouse gases.

For over two decades, the Convention on Long-range Transboundary Air Pollution has played a major role in protecting the environment from atmospheric pollution. Further work will continue with the upcoming reviews of the three most recent protocols, while the effective implementation of these protocols will need to be addressed as they enter into force. Communication between Parties, the sharing of best practices and the exchange of technology will assist Parties, not only in achieving their obligations under the Convention, but also in developing effective policies and strategies for air pollution abatement outside of their legal obligations. These efforts should go a long way toward cleaner air in Europe and North America and may serve as a model for other regions of the world.

Table 1 – Effects of Pollutants Covered by the Convention's Protocols

Pollutant	Health Effects	Ecological Effects
SO_2	• Respiratory diseases • Respiratory symptoms in asthmatics • Asthma attacks	• Acid rain (e.g. damage to fish populations and forest soils)
NO_x	• Lung irritation (e.g. inflammation, respiratory cell damage, premature ageing) • Increased susceptibility to respiratory infection • Respiratory diseases • Asthma attacks	• Acid rain (e.g. damage to fish populations and forest soils) • Eutrophication (e.g. disruption of ecosystem functions, acidification of surface and ground waters) • Regional haze
VOCs	• Lung irritation (e.g. inflammation, respiratory cell damage, premature ageing) • Increased susceptibility to respiratory infection • Asthma attacks	• Decreased commercial forest productivity • Damage to ecosystem functions • Regional haze
Ozone (from NO_x and VOC precursors)	• Lung inflammation • Respiratory disease (e.g. asthma & emphysema) • Impairment of immune system defenses • Hospital admissions for respiratory and cardiovascular causes	• Impede growth, reproduction & health of plants • Increase plants' susceptibility to disease, pests and environmental stresses • Reduce agricultural yields • Alter ecosystems through changes in water movement, mineral/nutrient cycling & habitat • Kill/damage leaves • Disintegrate organic materials
Heavy metals	• Food contamination • Premature death • Bronchitis - chronic and acute • Hospital admissions for respiratory and cardiovascular causes • Asthma attacks • Lower and upper respiratory illness • Blood disorders (e.g. lead poisoning) • Effects on functioning of liver, kidneys, circulatory and nervous systems • Effects on the development of the fetus and other human health problems caused by mercury in fish	• Affects on the decomposition of organic matter • Impairs the recycling of important forest nutrients • Reproductive problems in birds and other wildlife • Wildlife also harmed by mercury in fish
POPs	• Reproductive and immune effects • Developmental and behavioral abnormalities • Cancer	• Bioccumulates in animals • Ability to build up in the food chain
Ammonia	• Eye and upper respiratory tract irritation • Burning and scarring of tissues • High blood pressure • Lethal at higher concentrations (can cause blindness, lung damage, heart attack, death)	• Eutrophication (e.g. disruption of natural ecosystems) • Reduction in egg hatching success in fish, reduction in growth rate and morphological development (esp. gills, liver and kidney) • Toxic to fish and aquatic organisms at high concentrations

Table 2 – Status of ratification of protocols as of 4 October 2002 [a/]

Protocol	Open for signature	Entry into force [b/]	Number of signatures	Number of ratifications
Acidification, Eutrophication and Ground-level Ozone	1999		31	4 [c/]
Persistent Organic Pollutants	1998		36	13 [d/]
Heavy Metals	1998		36	12 [e/]
Further Reduction of Sulphur Emissions	1994	1998	28	25 [f/]
Volatile Organic Compounds	1991	1997	23	21 [g/]
Nitrogen Oxides	1988	1991	25	28 [h/]
Reduction in Sulphur Emissions	1985	1987	19	22 [i/]
European Monitoring and Evaluation Programme (EMEP)	1984	1988	22	39 [j/]

a/ Updated status can be found at http://www.unece.org/env/lrtap/cov/lrtap_s.htm.

b/ Sixteen ratifications are needed for a protocol to enter into force.

c/ Denmark, Luxembourg, Norway, Sweden.

d/ Austria, Bulgaria, Canada, Czech Republic, Denmark, Finland, Germany, Luxembourg, Netherlands, Norway, Republic of Moldova, Sweden, Switzerland.

e/ Canada, Czech Republic, Denmark, Finland, France, Luxembourg, Netherlands, Norway, Sweden, Switzerland, United States, European Community.

f/ Austria, Belgium, Canada, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Liechtenstein, Luxembourg, Monaco, Netherlands, Norway, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, European Community.

g/ Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Liechtenstein, Luxembourg, Monaco, Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland, United Kingdom.

h/ Austria, Belarus, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Liechtenstein, Luxembourg, Netherlands, Norway, Russian Federation, Slovakia, Spain, Sweden, Switzerland, Ukraine, United Kingdom, United States, European Community.

i/ Austria, Belarus, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Liechtenstein, Luxembourg, Netherlands, Norway, Russian Federation, Slovakia, Sweden, Switzerland, Ukraine.

j/ Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway, Poland, Portugal, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United States, Yugoslavia, European Community.

Further information on the Convention and its protocols may be obtained from the:

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