16 January 2005

Atmosphere/Air Pollution:

Best Practices, Lessons Learnt and Case Studies By UN Cooperative Programmes and Activities

Report of the Issue Management Group (IMG)

Of the

United Nations Environment Management Group (EMG)

Foreword

In the context of preparations for the 2006/2007 cycle of the CSD multi-year programme of work, the Secretariat of the UN Commission for Sustainable Development invited the UN Environmental Management Group (EMG) to report on cooperative UN activities related to the issues of "atmosphere/ air pollution" and "industrial development". The intention was to illustrate the experiences, lessons learned and best practices on specific environmental aspects of those issues.

The EMG was established to enhance UN system-wide inter-agency coordination related to specific issues in areas related to environment and human settlements and to enhance coherent and coordinated action within the UN system in these areas. The EMG is chaired by UNEP and it includes amongst its members the specialized agencies, funds and programmes of the UN system, as well as the secretariats of multilateral environmental agreements.

During the 10th meeting of the EMG, on 8 February 2005, the invitation was discussed with interest and accepted. Subsequently, EMG decided that two reports would be produced, one in the area of industrial development and one on atmosphere/air pollution. An Issue Management Group (IMG) was established for each report. The IMG for atmosphere/air pollution was chaired by the World Meteorological Organization (WMO) and it included representatives from the International Atomic Energy Agency (IAEA), the UN Economic Commission for Europe (UNECE), the UN Environment Programme (UNEP), the UN Economic and Social Commission for Western Asia (UN-ESCWA), the World Health Organization (WHO), the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, and the World Bank. This report was prepared with the assistance of a consultant. Participants and contributors are listed in Appendix 1

1. Introduction: The Nature Of Air Pollution And Its Relationship To Sustainable Development

The Millennium Development Goal #7 is "to ensure environmental sustainability". The scope of this goal is clearly very wide. It encompasses a large number of environmental issues and affects an even larger number of human activities. Neither the goal itself nor the indicators selected to monitor progress towards achievement of the goal mention the 'quality' of the atmosphere or air quality specifically. Rather, they concern human activities that ultimately affect the atmosphere. Some indicators of these effects are: the proportion of land covered by forest, the fraction of total area protected to maintain biological diversity, energy use per $1000 GDP, carbon dioxide emissions per capita, the emission of ozone-depleting CFCs to the atmosphere and the proportion of population using solid fuels. Nevertheless, it is implicit that protecting the atmosphere is vital for human health and functioning of the complex ecosystem on which our survival depends and as such, is vital to the realization of Millennium Development Goal #7.

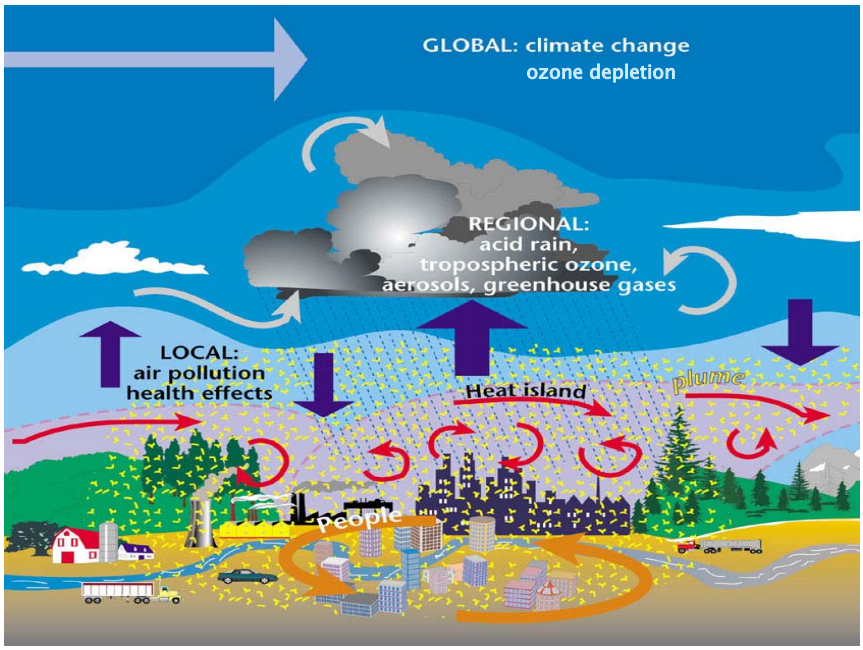

Figure 1. Air pollution occurs on all scales in the atmosphere from local to regional to global and requires collaboration by UN agencies for identifying and solving problems.

Threats to the atmosphere are the result of a large number of human activities occurring on a range of spatial scales from very local indoor air pollution to urban, regional, hemispheric and global pollution. This is illustrated in Figure 1. The cycle of air pollutants in the atmosphere from source to sink involves many processes that need to be understood and if possible controlled to mitigate pollution impacts.

The lack of clean fuels, particularly in developing countries has direct impact on indoor air quality in households which depend largely on wood, dung, crop residues and charcoal for cooking and heating. It is estimated that indoor air pollution from such fuels causes more than 1.6 million deaths per year, mostly among women and

children[1]. Urban air pollution, often associated with megacities, also affects a large fraction of the global population. It is responsible for more than 800,000 premature deaths every year[1]. WHO has recently updated its Air Quality Guidelines, providing globally applicable reference for air quality and reduction of the pollution-related health risk. (http://www.euro.who.int/air/activities/20050624_2).

When transported beyond city limits, urban pollution merges into a regional haze and eventually, depending on the lifetime of gas or particles in the atmosphere, into hemispheric or even global pollution. Human activities have resulted in changes to the chemical composition of the atmosphere globally and, hence, to weather and climate change as well as depletion of the stratospheric ozone layer. The latter are documented in quadrennial scientific assessment reports produced by the Intergovernmental Panel for Climate Change (IPCC) and under article 6 of the Montreal Protocol of the Vienna Convention for Protection of the Ozone Layer.

2. Atmosphere/ Air Pollution And Inter-Agency Coordination

UN organizations conduct a large number of cooperative programmes that serve to address diverse atmospheric pollution issues. Many of these are connected with international conventions such as the UNFCCC, the Vienna Convention on Protection of the Ozone Hole and the UNECE Convention on Long-range Transboundary Air Pollution and associated protocols. The list below is meant to provide examples of successful cooperative programmes carried out primarily by specialized UN agencies (and provided in this report by members of the IMG). It is not meant to be an exhaustive list of such cooperative efforts. Nor is it meant to document very important and useful partnerships carried out primarily by other national or international groups such as various *Partnerships for Sustainable Development*[2] registered with the Commission on Sustainable Development and contribute to the implementation of Agenda 21, Rio+5 and the Johannesburg Plan of Implementation.

2.1 Partnership for Clean Indoor Air

Worldwide, more than three billion people continue to rely on biomass fuels (wood, dung, charcoal) and coal to meet their basic household energy needs. Cooking and heating with such solid fuels on open fires or traditional stoves is the major source of indoor air pollution in developing countries. Indoor air pollution exposure is particularly high among women and children, who spend most of their time near the domestic hearth. Every year, indoor air pollution from solid fuels is responsible for the death of ~1.6 million people due to childhood pneumonia, chronic obstructive pulmonary disease as well as lung cancer induced by coal use.

[1] United Nations, 2005. The Millennium Development Goals Report 2005. http://www.un.org/millenniumgoals/index.asp
[2] http://www.un.org/esa/sustdev/partnerships/partnerships.htm

The *Partnership for Clean Indoor Air*, launched at the World Summit on Sustainable Development in 2002 aims to improve health, livelihood and quality of life by reducing exposure to air pollution from household energy use, primarily among women and children. Recent activities include a series of indoor air pollution advocacy seminars and a programme of regional capacity building workshops conducted in Africa, Central America and Asia. The partnership includes some 105 partners - including WHO, UNDP, UNEP, UNDESA, the World Bank as well as many other governmental and non-governmental partners.

It is yet too early to evaluate the effectiveness of the work of the Partnership. Nevertheless, some activities are under way and successful. For example, a study carried out by the Intermediate Technology Development Group/ Practical Action has shown that appropriate low-cost interventions such as smoke hoods or eaves spaces could reduce smoke and personal exposure substantially in two communities in Kenya. A follow-up project, funded by the United Kingdom and supported by WHO, aims to identify the best mechanisms for scaling-up a variety of successful interventions to reduce indoor air pollution in three countries (Kenya, Sudan and Nepal). An assessment of exposures to indoor air pollution and health outcomes in all three countries forms a key part of this project. More information is available at: http://www.who.int/indoorair/interventions/itdg/en/index.html.

Also, WHO is supporting a study in the rural highlands of Guatemala, which aims to measure the change in the incidence of acute lower respiratory infections in young children after the introduction of improved stoves. For more details, see: http://www.who.int/indoorair/interventions/guatemala/en/index.html).

The WHO keeps track and reports on the percentage of each country's population using solid fuels. This is one of the indicators to measure progress towards the attainment of Millennium Development Goals and the data are available on http://millenniumindicators.un.org/unsd/mi/mi_goals.asp.

2.2 The Partnership for Clean Fuels and Vehicles (PCFV)

The PCFV was formed in 2002 as a result of the discussions at the World Summit on Sustainable Development in Johannesburg. The Partnership addresses urban air quality through the use of clean fuels, namely the use of unleaded gasoline and low sulphur fuels, and clean vehicle options, focusing on the implementation of clean fuels and vehicles policies in the developing world. Today the partnership boasts some 80 partners representing governments, the private sector, international organizations and NGOs. The Clearing House for the PCFV is situated at UNEP headquarters in Nairobi, Kenya. The partners play a role often specified by their geographic proximity / interest in certain regions, sectoral expertise and financial capacities. With partner activities identified for the African, Asia/Pacific, Latin America/Caribbean and Central/Eastern Europe regions, the partnership has truly become a global one. Information about the Partnership as well as data about the phase-out of leaded gasoline and about vehicle emission standards is available on the Partnership's web site: http://www.unep.org/PCFV/Main/Main.htm

2.3 UNDP/RCA/IAEA Air Quality Monitoring

An effective monitoring capability is important for documenting and managing air quality in cities. Without such a capability the magnitude and sources of air pollution problems cannot be measured, cost-effective and targeted responses are impossible, and the success and otherwise of mitigation measures cannot be gauged.

A joint project by the UN Development Programme (UNDP), the Regional Co-operative Agreement for East Asia and Pacific Region (RCA) of the International Atomic Energy Agency (IAEA) aims to apply isotope and radiation technologies for better management of natural resources. As part of the project, 14 countries in the Asia and the Pacific Region established a network of multiple sampling stations and applied harmonised procedures for collection of air particulate matter in coarse (PM10) and fine (PM2.5) fractions. Nuclear analytical techniques are being used to assess the effectiveness of air quality management programs to provide greater source resolution, better quantification of the source contributions and estimates of the influence of distant, transboundary sources on the PM concentrations at the receptor site. Examples of 'success stories' are given below:

(i) In Bangladesh, the data generated by the project were used as basis for policy interventions to reduce air pollution which included a ban on the use of 2-stroke engine vehicles, old trucks and buses. Through the project, the impact of the removal of 2-stroke taxis in Dhaka was also assessed. Data from the project were used as basis for revising Air Quality standards and vehicular emission standards.

(ii) The Philippines adopted a Clean Air Act and promulgated a set of relevant regulations. Data generated by the project were included in the National Air Quality Status Reports required by the Clean Air Act.

(iii) In many countries data were submitted to the Ministries of Environment, Environmental Protection Agencies, Ministries of Health, etc.

(iv) A number of national seminars were organised for major stakeholders to identify end-users and disseminate the air pollution data obtained by nuclear analytical techniques. The project also contributed to research in the field of air pollution monitoring and air quality management in the Asia and Pacific region.

Currently the activities in air quality monitoring in Asia and Pacific Region are being continued under the RCA/IAEA-sponsored projects.

More information is available from:
http://www.rca.iaea.org/regional/html/projects/AirPollution.htm
and
http://www.iaea.org/OurWork/ST/NA/NAAL/pci/pcimain.php

2.4 GURME A Cooperative Programme For Urban Air Quality

The WMO-GAW Urban Research Meteorology and Environment (GURME) project was established in 1999 in response to requests for assistance in better management of urban environments. One objective was to enhance the capability, including those of developing countries, to provide urban environmental forecasting and air quality services of high quality. A second objective was to collaborate with WHO and other environmental agencies involved in air pollution studies to better define meteorological and air quality measurements needed to support urban air quality forecasting. These goals are pursued through a series of projects:

i) Atmospheric Environmental Pollution In Beijing
   This pilot project, coordinated by the Chinese Meteorological Administration, is focused on improving the understanding of pollution formation in the atmosphere, design of optimal schemes for monitoring, forecasting of pollution events, and fostering of improved prevention strategies.
ii) Sustainable Development Of The Moscow Megalopolis
   This demonstration project, coordinated by the Russian Federal Service for Hydrometeorology and Environmental Monitoring Roshydromet), is an integrated measurement and modelling study of linkages between weather, air quality and climate in the Moscow environment.
iii) Air Quality Measurements Using Passive Samplers
   This project supported by the NOAA/US Weather Service, is focused on the demonstration and extension of the capacity to monitor pollutants in background as well as urban air using passive samplers. Passive samplers are a potential cost-effective way for monitoring urban air pollution in developing countries.
iv) Improvement Of Air Quality Forecasting In Latin American Cities
   This project seeks to improve air quality forecasting in Latin American Cities (Mexico City, Santiago de Chile and Sao Paulo) through the organization of capacity building workshops and the transfer of knowledge to other cities in Latin America.

All of the above projects serve to bring together country agencies that are supported at an international level by UN agencies such as WMO, WHO, IAEA and UNEP in cross-disciplinary efforts on urban mega-city scales. For more information on GURME see: http://www.wmo.ch/web/arep/gaw/gaw_home.html

2.5 UNECE Convention on Long-range Transboundary Air Pollution

Acid rain and the acidification of lakes and rivers is probably the best-known problem caused by the long-range atmospheric transport of pollutants. Some air pollutants are carried by wind and weather systems for hundreds of kilometres and affect sensitive ecosystems downwind, with no regard to political boundaries. The massive increase in emissions of air pollutants due to economic and industrial growth in the last century made acidification an environmental problem of first order in a large number of European countries and in North America and is now an emerging problem in other

regions of the world. Other problems related to long-range transport of pollutants include: ground-level ozone which affects human health, vegetation and has corrosive effects on materials; eutrophication (over-fertilization) of some ecosystems due to excessive nitrogen deposition; as well as accumulation of heavy metals and persistent organic pollutants in ecosystems.

For 25 years, the UNECE Convention on Long-range Transboundary Air Pollution has provided a shining example to other regions in the world on how to understand and control regional air pollution. Through implementing eight protocols, the 49 Parties to the Convention have managed to control the emissions of specific air pollutants: sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC), ammonia, heavy metals, and persistent organic pollutants (POPs). Emissions of SO_2 are down by nearly 70% in Europe and more than 50% in North America from their 1980 levels (Fig.1). NO_x and VOC emissions are declining more slowly. Controls on POPs and heavy metals are being implemented. As a result, acidification of soils and waters in Europe and North America, the problem that prompted countries to sign the Convention, is now declining. Ambient levels of sulphur dioxide and sulphate have been observed to decrease consistent with the emissions reductions. All these activities have impact the improvement of human and environmental health.

A key to the success of the Convention has been the advancement of regional understanding of the problems through a spirit of political cooperation. This has been built, in a step-by-step process through the Convention's protocols and a consensus between countries on the need for emission controls. Indeed, the science-policy interaction has led to cost-effective abatement strategies based on the scientific information on emissions, atmospheric transport, effects and costs of abatement measures. Integrated assessment models have used these data to calculate least-cost, maximum benefit scenarios for Europe that have helped set national emission targets.

The most recent Protocol to the Convention entered into force in 2005. It aims to reduce acidification, eutrophication and ground-level ozone even more. Parties are now implementing measures to meet their emission targets set for 2010 but they also realise that the Protocol has limitations. Problems of excess nitrogen, ground-level

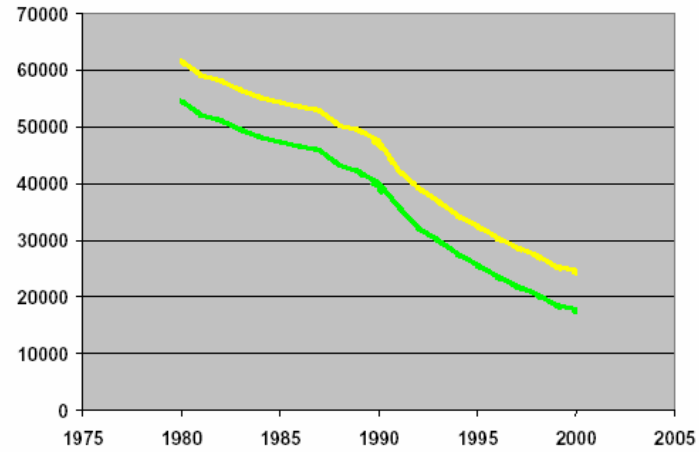

Figure 1. Annual emissions of SO_2 of European countries 1980 to 2000 (in ktonnes), including (yellow line) and excluding (green line) emissions from international shipping and natural sources. The Russian emission includes only the European part. (EMEP Assessment Report 2004)

ozone and fine particulate matter will continue into the future and new action is required, possibly through a new or revised protocol. Furthermore, Parties recognize that significant amounts of pollution can move between continents or regions and have established a new Task Force Hemispheric Transport of Air Pollution. This work brings UNECE experts together with those from countries outside Europe and North America to consider their common problems regarding the global scale movement of pollution. In other words, hemispheric scale pollution cannot be neglected in solving regional problems.

The Convention is promoting collaboration with other regions on issues of air pollution through a variety of actions. One way has been to use its European Monitoring and Evaluation Programme (EMEP), that has strong support from WMO and its Global Atmosphere Watch (GAW) programme, as a possible role model for other monitoring programmes especially those in Asia supported by UNEP and WMO-GAW. EMEP's experience of atmospheric monitoring and modelling provides an excellent example how scientific information can be gathered and used to support policy action.

Another valuable lesson from the Convention is that a good understanding of the harmful effects of air pollution is needed to reach agreement on effective pollution control. To gain the necessary information on the degree and geographic extent of the impacts on human health and the environment of major air pollutants the Convention established six International Cooperative Programmes. Each Programme has a lead country and has participation from experts of Parties to the Convention.

To provide a sound basis for considering the effects of air pollution on human health the Convention's Executive Body established a Joint Task Force on the Health Aspects of Air Pollution with WHO which has been led by WHO's European Centre for Environment and Health. The Joint Task Force has prepared state-of-the-art reports on direct and indirect effects of air pollutants on human health using experts nominated by Parties and by WHO. Since 1998 reports have covered the health risks of particulate matter, ozone, heavy metals and POPs. The recommendations of the Joint Task Force have provided essential input to the integrated assessment modelling of the effects of air pollution, which has quantified the impacts of particulate matter and ozone on health and life expectancy in Europe. The Joint Task Forcehas highlighted the significant effects of long-range transport air pollution and has brought human health issues to the mainstream of the work under the Convention, expanding the scope from the initial focus on ecosystem impacts. It will play an important role in the preparation of further instruments and actions for reducing air pollution. For more information see:
http://www.euro.who.int/eprise/main/WHO/Progs/AIQ/activities/20030528_4

So the Convention has a wealth of scientific knowledge which it can share with other regions. It is committed to providing help and guidance for developing networks to build observational systems of quality, and to apply the results to better understand and avoid air pollution related problems. This can be the basis of future emission control agreements. One important aim is to ensure that scientific approaches and measurements are harmonized and consistent with best practice.

For the future, a major challenge will be to link air pollution controls to other policy needs. For example, the Convention has recently considered the links and synergies between studies of regional effects of air pollution deposition with those of air pollution effects on human health and on global warming. Ozone precursors, particulate matter (i.e. aerosols) and greenhouse gases that affect climate as well as the human health and the biosphere are often emitted from the same sources.

The successes of the Convention can undoubtedly be attributed to the substantial scientific work that has enabled Parties to develop more and more advanced protocols, to a close interplay between scientists and policymakers and to the political backing which it has enjoyed[3]. It is very important that the protocols were based on sound science – provided in large part by the Convention's scientific networks on monitoring and modelling. The scientific results are important inputs to decision-making, in particular to calculate maximum benefit, cost-optimal abatement scenarios, which provide the basis for negotiating national emissions ceilings. It has used integrated assessment modelling to show that many countries would benefit from a combined strategy to meet targets set under the different legal instruments. This is one of best lessons that this mature programme has to offer other regions. A holistic approach to the environment and sustainable development is logical, since we share much of our environment, such as the atmosphere, and many issues are interlinked.
More information on the above aspects of the Convention can be found at this web site:
http://www.unece.org/env/lrtap/welcome.html

[3] From the statement by Knut Arild Hareide, Minister of Environment, Norway, on the occasion of the 25th anniversary of the Convention
http://www.unece.org/env/documents/2004/eb/Ministerial%20Statements/Norway.pdf

2.6 UN Support of the Vienna Convention on Protection of the Ozone Layer and its Protocols

The 20th Anniversary of the Vienna Convention on Protection of the Ozone Layer in September 2005 was a celebration of successful cooperation between UN agencies led by UNEP, WMO and the international research community represented by ICSU. The four year cycle of ongoing-research leading to scientific assessment followed by policy review and adjustment is a well established best practice with one clearly evident major lesson. The delivery of actions by industry, agencies and countries through a UN framework critically depends upon each organization in the UN doing what it is best suited to doing and a strong cooperative effort between them. For example, UNEP and WMO collaborated closely in organizing international research and building awareness amongst policy makers to lay the groundwork for the drafting and eventual signing of the Convention in 1985.

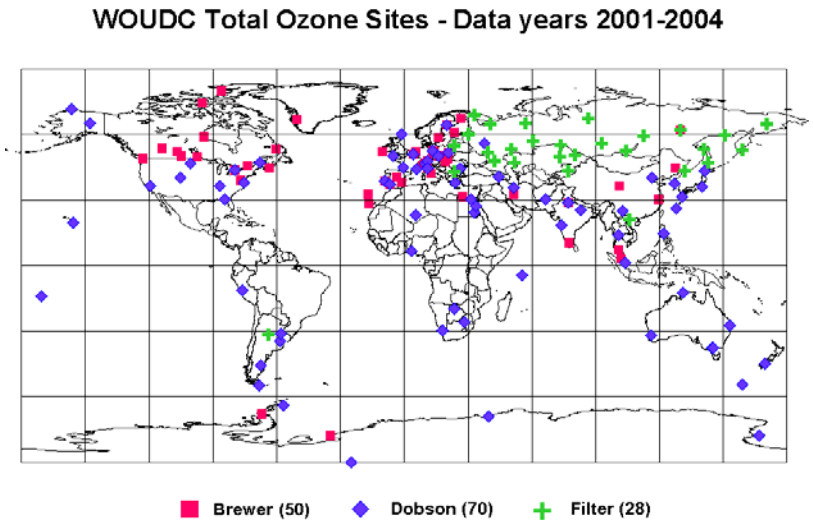

Fig 2. Surface-based total ozone network of WMO/GAW

The World Meteorological Organization through its Global Atmosphere Watch (GAW) programme and the efforts of the WMO Member countries and partners around the world is providing a global quality assurance system and surface-based ozone observing network that is a benchmark for all global observations, including satellites (Fig.2). Through the operation of the Ozone Secretariat to the convention, UNEP works with WMO/GAW to build capacity for ozone observations in developing countries, to organize meetings and publish the results of Ozone Research Managers of the Parties to the convention every three years.

UNEP through its network of environmental agencies and organization of industry leads a multi-agency group to coordinate the policy aspects related to emission controls. This has led to the Montreal Protocol in 1987, its subsequent amendments and adjustments, its protocols and subsequent amendments and adjustments. UNEP and WMO have jointly organized and published Ozone Scientific Assessments by the international research community every 4 years. As ozone depleting chlorine and bromine compounds peaked around the turn of the 20th century (Fig 3a), the depletion of ozone continues (Fig.3b) and is expected to continue for many decades. A

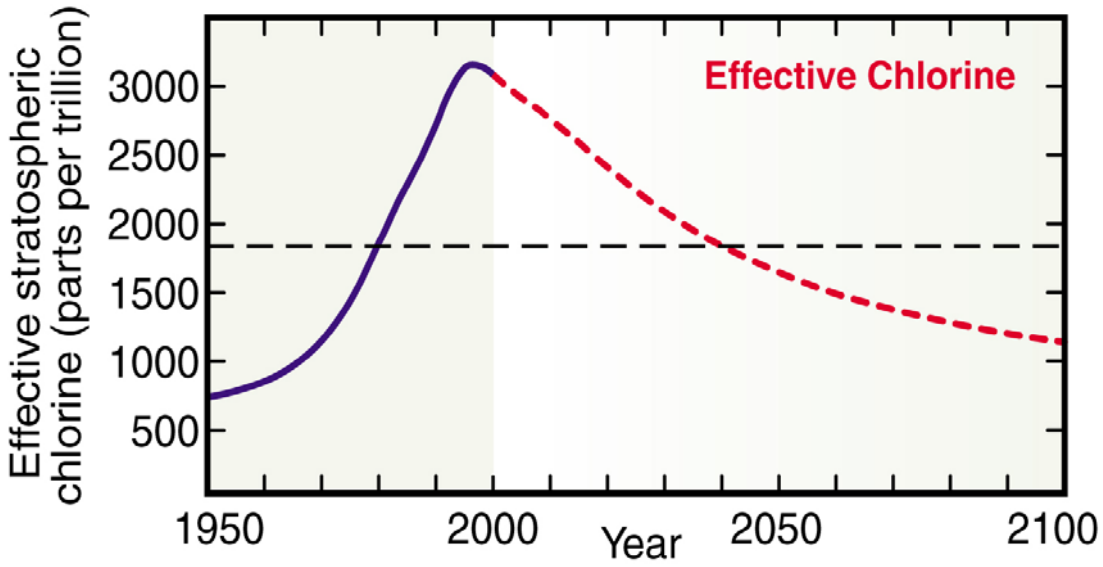

Fig. 3a UN support of the Vienna convention has led to a stabilization and expected future decline of ozone depleting halogen gases in the atmosphere (From UN Ozone Assessment 2002).

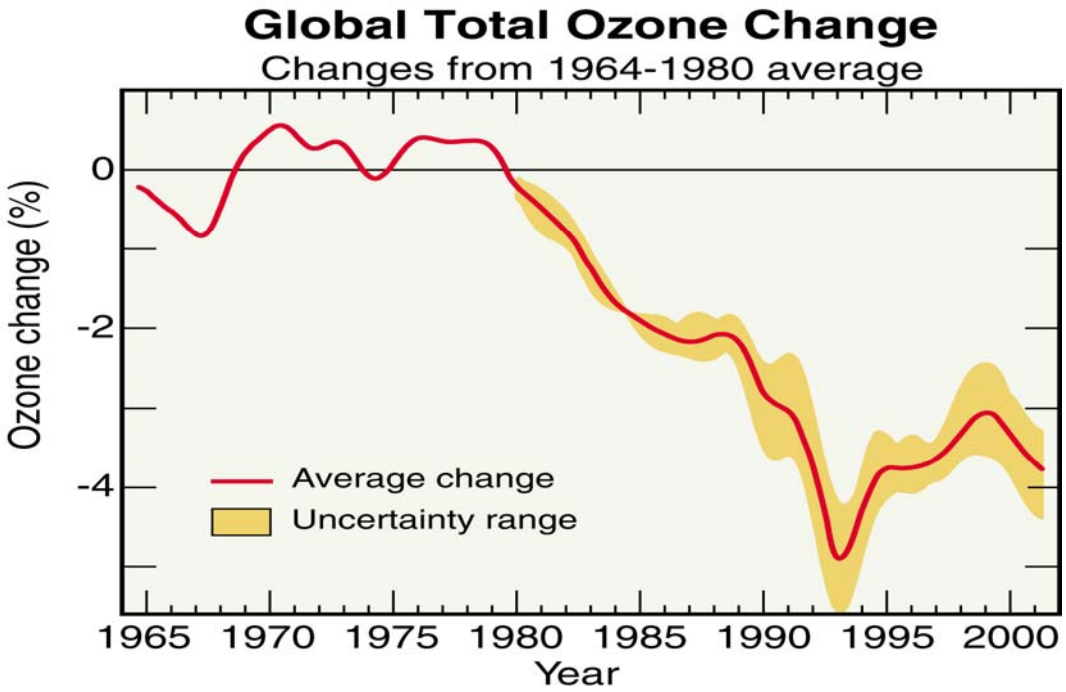

Fig. 3b Changes in ozone determined by surface-based observations (see Fig 2) and satellites are consistent with changes in ozone depleting halogens showm in Figure 2a. (UN Ozone Assessment 2002).

monitoring, assessment and policy review is required well into the latter half of the 21st century.

There is great concern for the expected rise in skin cancers and in cataracts likely to be associated with continuous ozone depletion. In the Global UV Project INTERSUN that was set up in response to Agenda 21 in 1995, WHO collaborates with the United Nations Environment Program (UNEP), the World Meteorological Organization (WMO), the International Agency on Cancer Research (IARC) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The overall aim of this project is the reduction of the global disease burden caused by exposure to UV radiation. The INTERSUN Project provides scientific information and practical advice including a range of educational materials on the health and environmental effects of UV exposure. A burden of disease assessment quantifying the health impact of UV is currently being finalized. The Project encourages countries to take action to reduce UV-induced health risks and provides guidance to national authorities and other agencies about effective sun awareness programmes (website for the Intersun Project: http://www.who.int/uv/intersunprogramme/en/).

2.7 A Cooperative UN Effort On Global Greenhouse Observation

In 2005, a landmark event took place marking the 30th anniversary of a cooperative effort by WMO and IAEA in bringing together the global greenhouse gas measurement community involved in long-term observations. The 13th WMO/IAEA Meeting of Experts on Measurements of Carbon Dioxide, Other Greenhouse Gases and Related Tracers (now held biennially) was hosted by NOAA US in Boulder Colorado. WMO brings its GAW global greenhouse gas network community to the forum while IAEA serves a complementary analytical community measuring isotopes of greenhouse gases. This biennial gathering of international technical experts and network operators results in workshop recommendations published by WMO in a report and distributed on the web[4]. This body essentially reviews technological developments in measurements related to the atmospheric greenhouse gas pollution and recommends "data quality objectives" to the WMO GAW Scientific Advisory Group on Greenhouse Gases. This long-term process is a "best practice", which would be well emulated by any measurement network. Sustained technical attention is brought to bear in maintaining high quality research and observations that are critical to the advancement of science. This science is critical to quadrennial assessment of

[4] For example, WMO GAW Report #161. 12th WMO/IAEA Meeting of Expert on Carbon Dioxide Concentration and Related Tracers Measurements Techniques (Toronto, Canada, 15-18 September 2003) website: http://www.wmo.ch/web/arep/gaw/gawreports.html

the Intergovernmental Panel on Climate Change (IPCC) and to the detection of global greenhouse gas trends (see below).

The above effort supports recommendations of the Global Climate Observing System (GCOS). GCOS is an international activity co-sponsored by WMO, IOC, UNEP and ICSU (http://www.wmo.ch/web/gcos/gcoshome.html). It has its Secretariat at WMO Geneva. In the past 3 years, its has completed an adequacy report for global climate observations, had it approved by the Parties to United Nations Framework Convention on Climate Change (UNFCCC) and, in autumn 2004, presented an Implementation Plan to UNFCCC. In these documents, GCOS has defined, for the atmosphere, ocean and terrestrial components of the climate system, Essential Climate Variables (ECVs) that need to be systematically measured accurately in a global network to address major issues defined in the adequacy report. Greenhouse gases, ozone and aerosols are GCOS ECVs. In October 2005, the GCOS Steering Committee accepted a "GCOS-GAW Agreement Establishing the WMO/GAW Global Atmospheric CO_2 & CH_4 Monitoring Network as a Comprehensive Network of GCOS". A cornerstone of this network is the US NOAA GMD climate research programme that maintains a World Reference Gases and operates a large number of stations in the global network (Fig. 4)

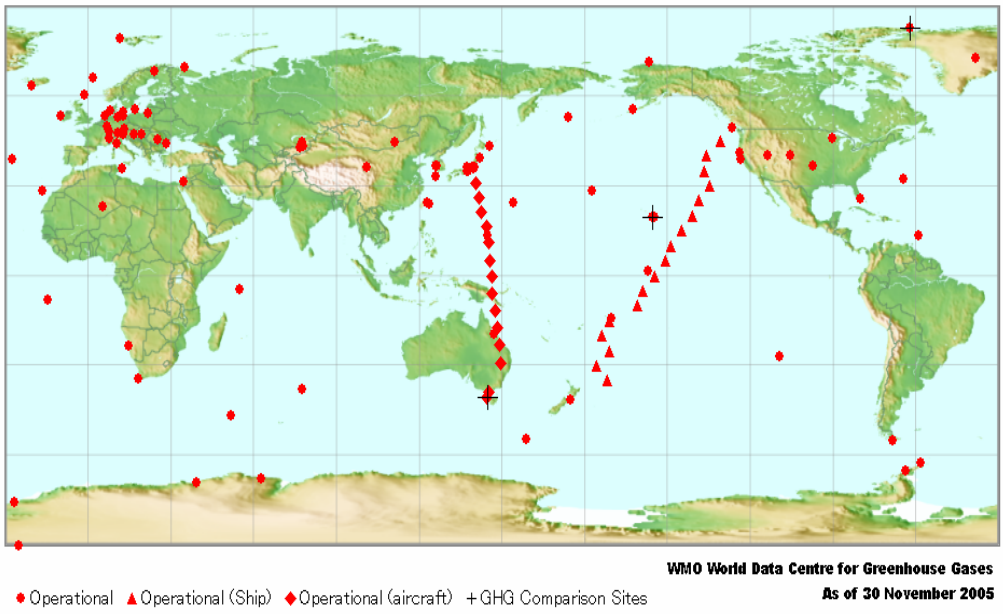

Figure 2 The WMO-GAW Global CO_2 Monitoring Network of November 2005; a comprehensive network of the Global Climate Observing System (GCOS). The CH_4 network is almost identical.

2.8 A Multi-Agency Strategy for Integrated Global Air Pollution Observations (IGACO)

The Integrated Global Observing Strategy (IGOS) is a consortium of thirteen international organisations that are concerned with global environmental change. The World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) are the principal UN organizations in IGOS dealing with air pollution observations and emissions. Other organizations deal with observing impacts on health, ecosystems and materials, as well as technologies to reduce pollutant emissions. The main objective of IGOS in air pollution is to integrate satellite, airborne and in situ atmospheric observation systems.

The IGOS Atmospheric Chemistry theme was approved for development in 2001. By May 2004, the theme report "Integrated Global Atmospheric Chemistry Observations (IGACO)" was produced and accepted for implementation by the IGOS consortium. An expert international group convened on behalf of IGOS by the World Meteorological Organization (WMO) and the European Space Agency (ESA) prepared it. Eminent scientists including two Nobel Prize winners reviewed it independently. IGACO is a highly focused strategy with well defined components designed to bring together ground-based, aircraft and satellite observations of thirteen target chemical groups in the atmosphere in order to address the socio-economic issues related to climate change, ozone depletion/ UV increase and air quality (see Fig. 5).

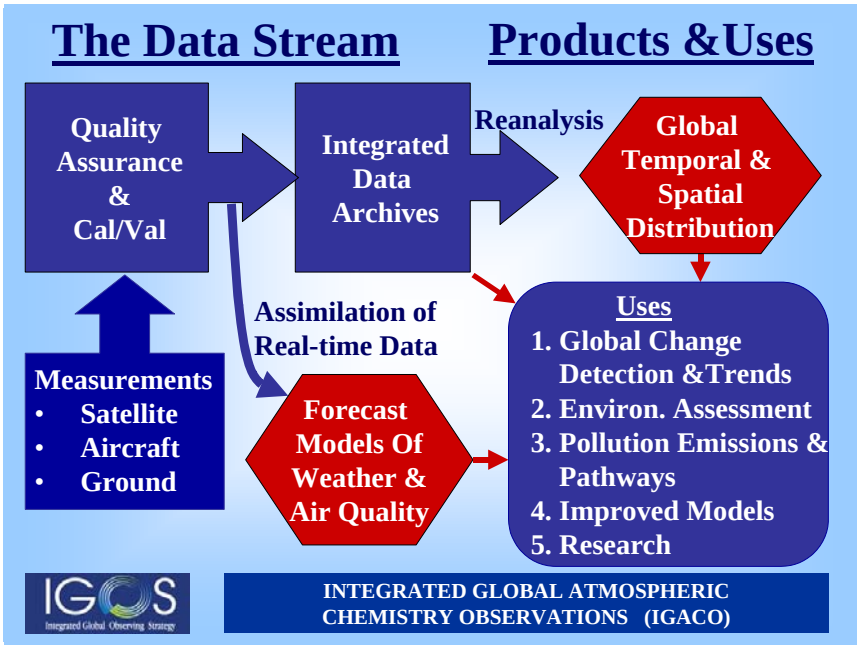

Figure 5. Components of an integrated global air pollution observation framework that UN organizations are leaders in building.

IGACO critically assessed the accuracy/precision and spatial/temporal resolution requirements for observational networks and satellites. It recommended specific steps to be taken in a phased approach over the next 15 years. IGOS has designated WMO and its Global Atmosphere Watch (GAW) programme as the lead for coordinating the implementation of IGACO. This comes as a result of best practices developed by WMO in coordinating global weather and climate observations for better weather forecasting and climate change studies. These best practices will now be applied to coordinating observations of ozone, aerosols and greenhouse gases that are recognized as "essential climate variables" by the UNFCC.

3. Partnerships for Sustainable Development

As indicated earlier, this report is focused on highlights of successful collaborative UN agency efforts. Nevertheless, the following short list of other relevant collaborative sustainable development efforts is presented to indicate the scope of the overall global activity. *Partnerships for sustainable development* are voluntary initiatives undertaken by governments and relevant stakeholders that are specifically intended to strengthen the implementation of the UN sustainable development initiative (Agenda 21). There are more than 300 partnerships registered with the Secretariat of the Commission for Sustainable Development. Of these, several have Air pollution/Atmosphere as a primary or secondary theme. For example:

3.1 Asian Partnership Programme towards shared prosperity (ASPRO)

The main aim of this inter-city environmental partnership is to foster local-to-local cooperation through Asia, beyond national borders

3.2 Children Environmental Health Indicators

Acute respiratory infections annually kill an estimated 2 million children under the age of 15, and as much as 60% of acute respiratory infections worldwide are related to environmental conditions. The goal of this multi-year initiative is to develop and test indicators for environmental health of children and to facilitate sound environment and health policy-making.

3.3 ECOLEX – a global partnership for information on environmental law

The objective is to increase access to authoritative information on environmental law by establishing a single gateway on the Internet and publishing a range of products on specific topics.

3.4 The Encyclopaedia of Life Support Systems (EOLSS)

The mission of EOLSS is to present a comprehensive, authoritative and integrated body of knowledge of life support systems. It offers the world biggest web-based archive as trans-disciplinary knowledge base of sustainable development.

3.5 Energy and Environment Partnership with Central America

The main objective of the Partnership is to promote the use of renewable energy sources and clean technologies and to make energy services more accessible to the poor, particularly to those in rural areas.

3.6 Enhancement of regional strategy on climate change through the Asia-Pacific Network on Climate Change (AP-Net)

The aim of the strategy is to promote policy dialogue among countries, exchange experiences, data and information among all relevant actors in the region to build an institutional capacity.

3.7 Mandatory Disclosure of Automotive Emissions

The goal is to develop a uniform mandatory disclosure scheme on emissions of motor vehicles within respective ASEAN countries.

3.8 Mediaterre – Global information system on sustainable development

The aim is to create an information and discussion platform for sustainable development accessible to various the groups concerned throughout the French-speaking world.

3.9 MeditAIRaneo

The aim is to support the preparation of consistent and reliable inventories of greenhouse gases in Mediterranean countries. It promotes exchanges of information on activity indicators and emission factors, identification of QA/QC procedures and development of common technologies.

3.10 Network of Regional Governments for Sustainable Development (NRG4SD)

The aim is to promote understanding, collaboration and partnerships in sustainable development through sharing information and experiences.

3.11 Networked Environmental Information System for Global Emissions Inventories (NEISGEI)

NEISGEI consists of a globally-distributed database of air pollutant emissions plus software, and a global network of air emissions experts.

4. Summary and Conclusions

In reviewing major cooperative UN efforts and programmes related to atmospheric pollution, this Issues Management Group has compiled some striking examples of the range, depth and sustained nature of UN expertise and partnerships that have formed over the past 50 years in response to national needs. The fact that pollution knows no boundaries, ranges in scale from urban to regional to global and is a complex mixture of chemicals with different impacts on people, ecosystems, weather and climate necessitates a broad spectrum of action that is indeed reflected in the activities of this report.

Despite differences in the geographical extent of air pollution problems ranging from indoor environments to cities to surrounding regions and hence to global effects, there are certain common elements involved in finding a solution. These are sound-science, accurate sustained observations, regular scientific assessment with a strong link to policy through some cooperative mechanism (convention, treaty etc). UN agencies play a role in every aspect.

As demonstrated by many outstanding examples, cooperative UN efforts, although sometimes difficult to maintain, are absolutely necessary in finding an ultimate solution to pollution problems. A shining example is WMO and UNEP working together with each other and with national partners to establish the Vienna Convention on Protection of the Ozone Layer in 1985 followed by the Montreal Protocol in 1987 and its subsequent amendments. Both agencies have and will complement each other in follow-up action needed over following decades. This is needed to ensure that ozone depleting pollutants drop from their current maximum as expected and ozone levels rebound from their current minimum. UNEP manages the secretariat and mobilizes industry in finding solutions to halogen emissions while WMO maintains a globally standardized observational capability to monitor ozone changes. Thus, cooperation between UN agencies each with access globally and with unique complementary skills comes into play in providing scientific and technological solutions. Because skills of each organization are complementary rather than redundant collaboration is not only desirable but essential.

Another excellent example of a coordinated multi-national and multi-UN agency effort is the UNECE Convention on Long-range Transboundary Air Pollution and its programmes now 26 years old. It began as an acid rain programme but has evolved to deal with most major air pollutants. It has used integrated assessment modelling to show that many countries benefit from combined strategies to meet targets set under the different legal instruments. This is one of the “lessons learned” that this mature programme can offer to other regions such as the emerging economies of Asia. In general, a holistic approach to the environment and sustainable development is needed.

An important “best practice” that has emerged from this IMG analysis is related to the long term maintenance of best methodologies, quality assurance and standardization of atmospheric observational networks. It is essential that sustained technical resources are applied to the maintenance of high quality observations that are critical to the advancement of science of an air pollution issue (witness the cooperative UN

effort by WMO and IAEA in supporting the biennial Greenhouse Gas Measurement Experts Forum to review best methodologies and practices over the past thirty years).

Despite the successes in UN cooperative efforts related to atmospheric air pollution there is still room for improvement. Two major gaps can be identified:

1. There is a lack of awareness *at the technical level* in organizations of each other's activities and programmes related to air pollution. An *internal* "UN Technical Forum on UN Air Pollution Activities From Urban to Global Scales" every four years would promote information exchange and integration. Co-sponsored and organized by the specialized agencies involved (e.g UNEP, WMO, UNECE, IAEA, WHO), it would bring together leaders of the technical programmes to document activities and to identify potential areas of cooperation.

2. In urban mega-city regions, there is a need for UN agencies to encourage and support their country counterparts in developing cooperative air quality management tools and plans. For instance, the GURME city projects in Beijing, Moscow and Latin America would benefit from cooperative efforts between national meteorological and hydrological services, environmental protection agencies and health agencies.

It should be emphasized that, in addressing shortcomings such as those above, cross-cutting initiatives should add support to individual on-going programmes rather than drain energy and resources away from them. There is a delicate balance to be struck that requires careful consideration and planning. Currently, many UN programmes relevant to air pollution are under-resourced at the technical level and would suffer if a crosscutting initiative demanded too much time and effort. However activities, such as the technical forum suggested above, that would promote effective communication leading to more efficient ways of achieving goals are very useful.

Acknowledgements

The chairman Dr. Leonard A. Barrie of WMO extends thanks to all those contributing to this report and to the EMG Secretariat directed by Dr. Halifa Drammeh and his staff Mr. Hossein Fadaei. In particular, we wish to thank the contractor Mr. Guy Fenech who provided administrative and editorial support in managing and organizing the document.

Appendix 1

IMG on Atmosphere/Air Pollution Participants And Contributors

ORG	NAME	EMAIL	CITY
CHAIR - WMO	Mr. Leonard Barrie	Lbarrie@wmo.int	Geneva
Consultant	Mr. Guy Fenech	guyfenech@ktdbroadband.com	UK
Basel Convention	Mr Andreas Arlt	andreas.arlt@unep.ch	Geneva
EMG	Mr. Hossein Fadaei	hossein.fadaei@unep.ch	Geneva
IAEA	Ms. Gabriele Voigt	g.voigt@iaea.org	Vienna
IAEA	Mr. Andrzej Markowicz	a.markowicz@iaea.org	Vienna
ICSU	Ms. Leah Goldfarb	leah@icsu.org	Paris
ILO	Mr. Pavan Baichoo	baichoo@ilo.org	Geneva
UNDESA	Mr. Frediech Soltau	soltau@un.org	NYC
UNECE	Mr. Keith Bull	keith.bull@unece.org	Geneva
UNECE	Ms. Albena Karadjova	albena.karadjova@unece.org	Geneva
UNECE	Ms. Christina von Schweinichen	christina.schweinichen@unece.org	Geneva
UNEP DPDL	Mr. Rob Jong	rob.jong@unep.org	Nairobi
UNEP DTIE	Mr. Etienne Gonin	egonin@unep.fr	Paris
UNEP DTIE	Mr. Raj Shende	rajendra.shende@unep.fr	Paris
UN-ESCWA	Mr. Hosny Khordagui	khordagui@un.org	Beirut
UN-ESCWA	Ms. Anhar Hegazi	hegazi@un.org	Beirut
WHO	Ms. Annette Pruess-Ustun	pruessa@who.int	Geneva
WMO	Mr. Yinka Adebayo	yadebayo@wmo.int	Geneva
WMO	Ms. Liisa Jalkanen	ljalkanen@wmo.int	Geneva
World Bank	Mr. Todd Johnson	tjohnson@worldbank.org	Washington, D.C.
WHO	Ms. Eileen Brown	browne@who.int	Geneva
WHO	Ms. Eva Rehfuess	rehfuesse@who.int	Geneva