

## INTRODUCTION

### 1 EMISSIONS AND EMISSION INVENTORIES

Substances emitted into the atmosphere by human and natural activities are the cause of many current and potential environmental problems, including:

- acidification
- air quality degradation
- global warming/climate change
- damage and soiling of buildings and other structures
- stratospheric ozone depletion
- human and ecosystem exposure to hazardous substances.

It is necessary to have quantitative information on these emissions and their sources in order to help:

- inform the policy makers and the public
- define environmental priorities and identify the activities and actors responsible for the problems
- set explicit objectives and constraints
- assess the potential environmental impacts and implications of different strategies and plans
- evaluate the environmental costs and benefits of different policies
- monitor the state of the environment to check that targets are being achieved
- monitor policy action to ensure that it is having the desired effects
- ensure that those responsible for implementing the policies are complying with their obligations.

There are many types of sources of atmospheric emissions and many examples (often millions) of each type, for example:

- power plants
- refineries
- incinerators
- factories
- domestic households
- cars and other vehicles
- animals and humans
- fossil fuel extraction and production sites
- offices and public buildings
- trees and other vegetation

- distribution pipelines
- fertilised land
- land with biological decay.

It is not possible to measure emissions from all of the individual examples of these sources or, in the short term, from all the different source types. In practice, atmospheric emissions are estimated on the basis of measurements made at selected or representative samples of the (main) sources and source types.

The basic model for an emission estimate is the product of (at least) two variables, for example:

- an activity statistic and a typical average emission factor for the activity, or
- an emission measurement over a period of time and the number of such periods emissions occurred in the required estimation period.

For example, to estimate annual emissions of sulphur dioxide in grams per year from an oil-fired power plant you might use, either:

- annual fuel consumption (in tonnes fuel/year) and an emission factor (in grams SO<sub>2</sub> emitted/tonne fuel consumed), or
- measured SO<sub>2</sub> emissions (in grams per hour) and number of operating hours per year.

In practice, the calculations tend to more complicated but the principles remain the same.

Emission estimates are collected together into inventories or databases which usually also contain supporting data on, for example: the locations of the sources of emissions; emission measurements where available; emission factors; capacity, production or activity rates in the various source sectors; operating conditions; methods of measurement or estimation, etc.

Emission inventories may contain data on three types of source, namely point, area and line. However, in some inventories all of the data may be on area basis - region, country, sub-region etc.

Point sources - emission estimates are provided on an individual plant or emission outlet (usually large) usually in conjunction with data on location, capacity or throughput, operating conditions etc. The tendency is for more sources to be provided as point sources as legislative requirements extend to more source types and pollutants as well as more openness provides more such relevant data.

Area sources - smaller or more diffuse sources of pollution are provided on an area basis either for administrative areas, such as counties, regions etc, or for regular grids (for example the EMEP 50x50 km grid).

Line sources - in some inventories, vehicle emissions from road transport, railways, inland navigation, shipping or aviation etc are provided for sections along the line of the road, railway-track, sea-lane etc.

## **2 INTERNATIONAL REQUIREMENTS FOR EMISSION INVENTORIES**

### **2.1 Long Range Transboundary Air Pollution Convention**

The Convention on Long Range Transboundary Air Pollution (LRTAP) was adopted in Geneva in 1979. Reporting of emission data to the Executive Body of the Convention is required in order to fulfil obligations regarding strategies and policies in compliance with the implementation of Protocols under the Convention. These Protocols are:

- the Helsinki Sulphur Protocol (1985)
- the Sofia NO<sub>x</sub> Protocol (1988)
- the Geneva VOC Protocol (1991)
- the Oslo Sulphur Protocol (1994)
- the Aarhus Protocols on Heavy Metal and on Persistent Organic Pollutants (POPs).

Parties should use the draft reporting procedures (EB.AIR/GE.1/1997/5) and are required to submit annual national emissions of SO<sub>2</sub>, NO<sub>x</sub>, NMVOC, CH<sub>4</sub>, CO and NH<sub>3</sub> and various heavy metals and POPs using the 11 main source categories (level 1 of SNAP, Selected Nomenclature for sources of Air Pollution) by the 31 December following each year. For example, Parties were requested to submit data for 1997 to the Executive Body (UNECE/CLRTAP Secretariat) by 31 December 1998. Parties are invited to also report emissions of more detailed sub-sectors (SNAP level 2).

Parties are also required to provide EMEP periodically with emission data within grid elements of 50km x 50km, as defined by EMEP and known as the EMEP grid.

Parties should use the EMEP/CORINAIR Atmospheric Emission Inventory Guidebook both as a reference book on good emission estimation practice and as a check-list to ensure that all relevant activities are considered and their emissions quantified. Parties should indicate where the Guidebook methodology has been used and where not. If another methodology has been used Parties are requested to provide additional explanatory information.

## 2.2 United Nations Framework Convention on Climate Change (UNFCCC)

"The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve stabilisation of greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner." (Article 2).

All Parties to the Convention shall " develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties;" (Article 4, paragraph 1(a)).

Parties are required to report emissions and sink estimates by 15 April for the last year but one of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF<sub>6</sub>). For example data for 1997 should be reported by 15 April 1999 to the UNFCCC Secretariat. Parties should also provide information on emissions of carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>) and non-methane volatile organic compounds (NMVOCs) and are encouraged to provide information of emissions of sulphur oxides (SO<sub>2</sub>).

UNFCCC requires Parties to use the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories ("IPCC Guidelines"). Parties may use different methods ("tiers"), giving priority to those methods which are believed to produce the most accurate estimates, and Parties can also use national methodologies which they consider better able to reflect their national situation provided that these methodologies are compatible with the IPCC Guidelines and are well documented (FCCC/SBSTA/1999/L.5).

Within the framework of UNFCCC continuing efforts are aimed at improving transparency, consistency, comparability, accuracy and completeness of inventories, resulting in proposals for a new detailed "common reporting format" (CRF) and for preparing and providing access to, an annual updated, detailed and complete national inventory report for all years. These proposals are expected to be adopted at COP5 in Bonn (25 October - 5 November 1999). This would mean Parties would be requested to start with the new Common Reporting Format (CRF) on a trial basis in the years 2000 and 2001.

Within the IPCC-OECD-IEA Programme on Inventories, and continued in 1999/2000 by the IPCC Task Force on Inventories, guidance has been developed on Good Practices as well as on Managing Uncertainties. The guidance document "*Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*" was finalised, accepted and published in 2000. Guidance includes advice on choice of methodology, emission factor, activity data, and uncertainties, and on a series of quality assessment and quality control procedures, which may be applied during the preparation of inventories. It is available from the IPCC National Greenhouse Gas Inventories Programme, Technical Support Unit. C/O

Institute for Global Environmental Strategies, 1560-39 Kamiyamaguchi, Hayama, Kanagawa, Japan 240-0198; E-mail [tsu@iges.or.jp](mailto:tsu@iges.or.jp). Alternatively it may be downloaded from their website at:  
<http://www.ipcc-nggip.iges.or.jp>

### **2.3 Amended Council Decision 99/296/EC on a Monitoring Mechanism of Community CO<sub>2</sub> and other Greenhouse Gas Emissions**

The European Community has adopted Council Decision 93/389/EEC to help monitor progress towards stabilisation of the total CO<sub>2</sub> emissions by 2000 at the 1990 level in the Community as a whole.

In 1999 this Decision has been amended by Council Decision 99/296/EC (26 April 1999) Amending Decision 93/389/EEC for a monitoring mechanism on CO<sub>2</sub> and other greenhouse gas emissions. The original Decision of 1993 has been amended to allow for the updating of the monitoring process, in particular regarding:

- the post 2000 monitoring of greenhouse gas (GHG) emission limitations and reductions,
- the application to all six Kyoto Protocol greenhouse gases (carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF<sub>6</sub>),
- the requirements of the Kyoto Protocol to the UNFCCC for the EU and its Member States. The EU committed to a reduction of the emissions of the six Kyoto Protocol gases by 8% in 2008-2012 from 1990 levels.

According to Article 3.2 “Member States shall each year, not later than 31 December, report to the Commission their anthropogenic CO<sub>2</sub> emissions and removal by sinks for the previous calendar year. Member States shall also report national inventory data on emissions/removal of the six Kyoto GHG on an annual basis. They shall report to the Commission by 31 December year Y their final data for year Y-2, and provisional data for year Y-1. (*Art 3.2*). For example data for 1997 should be reported by 15 April 1999 to the Commission. According to Article 3.3 “The Commission shall establish inventories of emission/removal in the Community and circulate them by 1 March”.

Member States shall also report by 31 December on the most recent projected emissions for the period 2008-2012, and as far as possible, for 2005 (*Art 3.2*).

Inventories are established in accordance with the methodologies accepted by IPCC and agreed upon by the Conference of Parties (*art 3.1*).

The Commission shall take further steps to promote the comparability and transparency of national inventories and reporting (*Art.3.2*).

### 3 ATMOSPHERIC EMISSION INVENTORY METHODOLOGY

There have been several major international initiatives over the past 10 years that have built on each other and helped develop the emission inventory methodology to its current state. These include:

- the OECD Control of Major Air Pollutants (MAP) Project
- the DGXI Inventory
- the CORINE Programme and subsequent work by the European Environment Agency Task Force
- the Co-operative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe (EMEP)
- the IPCC/OECD Greenhouse Gas Emissions Programme.

#### 3.1 OECD/MAP Project

The MAP Project was designed (OECD, 1990) to:

- assess pollution by large scale photochemical oxidant episodes in Western Europe and
- evaluate the impact of various emission control strategies for such episodes.

The Project started in 1983 and the report on the work was published in 1990.

The MAP emission inventory covered the following pollutants:

- sulphur dioxide - SO<sub>2</sub>
- nitrogen oxides - NO<sub>x</sub>, and
- volatile organic compounds - VOC, including natural emissions.

The inventory quantified point and area source emissions in nine main source sectors from 17 European OECD countries - the current 15 Member States (excluding the former German Democratic Republic) plus Norway and Switzerland.

The nine main source sectors were:

- mobile
- power plant
- non-industrial combustion
- industry
- organic solvent evaporation
- waste treatment and disposal
- agriculture and food industry
- nature
- miscellaneous

In most but not all cases the inventory was compiled from emission estimates submitted officially by each country. OECD worked closely with each country and with the CEC (which funded activity on the inventory to regroup emission estimates into the OECD source sectors and to help countries complete their inventories).

### 3.2 The DGXI Inventory

In 1985, the CEC Environment Directorate (DGXI) funded the compilation of an emission inventory for the EU12 Member States (Spain and Portugal joined the European Community during the course of the work) in 1980 and 1983.

The aim of the DGXI Inventory was (CITEPA, 1988) to collect data on emissions from all relevant sources in order to produce a database for use in the study of air pollution problems and to base policy measures in the field of air pollution control.

The inventory covered four pollutants - SO<sub>2</sub>, NO<sub>x</sub>, VOC and particulates - and recognised 10 main source sectors:

- utility power plant
- industrial combustion plant
- district heating
- oil refineries and petrochemical plant
- domestic heating
- industrial processes
- solvent use
- transportation
- agriculture
- nature.

The work, which was completed with the publication of the report in 1988, was carried out under contract by a group of four national laboratories/consultancies in collaboration with the Member States and OECD, who were simultaneously compiling the MAP Inventory.

### 3.3 CORINE and the EEA Task Force

Council Decision 85/338/EEC (OJ, 1985) established a work programme concerning an "experimental project for gathering, co-ordinating and ensuring the consistency of information on the state of the environment and natural resources in the Community". The work programme was given the name CORINE - CO-oRdination d'Information Environnementale and include a project to gather and organise information on emissions into the air relevant to acid deposition - CORINAIR. This project started in 1986 with the objective of compiling a co-ordinated inventory of atmospheric emissions from the 12 Member States of the Community in 1985 (CORINAIR 1985).

The CORINAIR 1985 Inventory covered three pollutants - SO<sub>2</sub>, NO<sub>x</sub>, and VOC (total volatile organic compounds) - and recognised eight main source sectors:

- combustion (including power plant but excluding other industry)
- oil refineries
- industrial combustion
- processes
- solvent evaporation
- road transportation
- nature and
- miscellaneous.

The project also developed :

- a source sector nomenclature - NAPSEA, Nomenclature for Air Pollution Socio-Economic Activity and SNAP, Selected Nomenclature for Air Pollution - for emission source sectors, sub-sectors and activities
- a Default Emission Factor Handbook and
- a computer software package for data input and the calculation of sectorial, regional and national emission estimates.

The CORINAIR 1985 Inventory was developed in collaboration with the Member States, Eurostat, OECD and UNECE/EMEP.

The Inventory was completed in 1990 and the results have been published (Eurostat, 1991; CEC, 1995) and widely distributed in tabular and map forms.

Pending a decision on the location of the EEA, it was agreed in 1991 to produce an update of CORINAIR for 1990 (CORINAIR 1990). This update has been performed in co-operation with EMEP and IPCC-OECD to assist in the preparation of inventories required under the Long Range Transboundary Air Pollution (LRTAP) Convention and the Framework Climate Change Convention (FCCC) respectively.

The CORINAIR90 system was made available to :

- the 12 member states of the European Community in 1990: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and United Kingdom
- 5 EFTA countries: Austria, Finland, Norway, Sweden and Switzerland
- 3 Baltic States: Estonia, Latvia and Lithuania
- 9 Central and Eastern European countries: Albania, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia and
- Russia.



This collaboration:

- produced a more developed nomenclature (source sector split) - SNAP90 - involving over 260 activities grouped into a three level hierarchy of sub-sectors and 11 main sectors
- extended the list of pollutants to be covered to eight:
  - sulphur dioxide (SO<sub>2</sub>)
  - oxides of nitrogen (NO<sub>x</sub>)
  - non-methane volatile organic compounds (NMVOC)
  - ammonia
  - carbon monoxide
  - methane
  - nitrous oxide
  - carbon dioxide
- extended the number of sources to be considered as point sources (there were over 1400 large point sources in the CORINAIR85 inventory)
- recognised that an emission inventory needs to be complete, consistent and transparent
- extended the availability of the CORINAIR system to 30 countries
- increased awareness of CORINAIR and the need to produce an inventory within a reasonable time-scale to serve the requirements of the user community (policy-makers, researchers etc).

The CORINAIR 1990 Inventory recognises 11 main source sectors (as agreed with EMEP, see below):

- Public power, cogeneration and district heating plants
- Commercial, institutional and residential combustion plants
- Industrial combustion
- Production processes
- Extraction and distribution of fossil fuels
- Solvent use
- Road transport
- Other mobile sources and machinery
- Waste treatment and disposal
- Agriculture
- Nature.

Data are provided on large point sources on an individual basis and on other smaller or more diffuse on an area basis, usually by administrative boundary at the county, department level (NUTS level 3). The sources to be provided as point sources are:

- Power plant with thermal input capacity  $\geq 300$  MW
- Refineries
- Sulphuric acid plant
- Nitric acid plant
- Integrated iron/steel with production capacity  $> 3$  Mt/yr
- Paper pulp plant with production capacity  $> 100$  kt/yr
- Large vehicle paint plant with production capacity  $> 100000$  vehicles/yr
- Airports with  $> 100000$  LTO cycles/yr
- Other plant emitting  $\geq 1000$  t/yr  $\text{SO}_2$ ,  $\text{NO}_x$  or VOC  
or  $\geq 3000000$  t/yr  $\text{CO}_2$

The **Goal of CORINAIR90** is to provide a complete, consistent and transparent air pollutant emission inventory for Europe in 1990 within a reasonable time scale to enable widespread use of the inventory for policy, research and other purposes.

**Completeness** covers two aspects: the CORINAIR90 system is available to almost all countries of Europe and the SNAP90 nomenclature has been designed to provide a comprehensive list of activities generating emissions of the eight pollutants to be quantified.

**Consistency** will be provided by the systematic application of the CORINAIR methodology - by using the CORINAIR software and the SNAP90 nomenclature - to provide emission estimates.

**Transparency** will be achieved through the provision within the inventory of activity statistics/data and emission factors (or details of emission measurements where available) used to calculate emissions and through the supply of full references to the sources of these data.

Initial data from CORINAIR90 became available in early 1994 and the project was completed and a series of reports prepared during 1995 and early 1996.

The work was finalised and published by the EEA in 1996 and 1997 (see under section 5).

### 3.4 EMEP

The Cooperative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe (EMEP) formed by a Protocol under the Long Range Transboundary Air Pollution Convention has arranged a series of workshops on Emission Inventory Techniques to develop guidelines for estimation and reporting of emission data for

SO<sub>x</sub>, NO<sub>x</sub>, NMVOCs, CH<sub>4</sub>, NH<sub>3</sub> and CO under the Convention. The 1991 Workshop agreed to recommend that:

- a task force on emission inventories should be established by the Executive Body of the Convention to review present emission inventories and reporting procedures for the purpose of further improvement and harmonisation, and
- the EMEP Steering Body should approve the guidelines prepared by the workshop for estimation and reporting for submission to the Executive Body of the Convention.

These guidelines included a recommendation that emission data should be reported as totals and at least for the 11 major source categories agreed with the CORINAIR project and other experts for the CORINAIR 1990 Inventory (see above).

The proposed task force was set up under the EMEP Steering Body with leadership from the United Kingdom and support from Germany and the European Community (including the European Environment Agency).

The objectives of the task force are to:

- provide a technical forum to discuss, exchange information and harmonise emission inventories including emission factors, methodologies and guidelines
- conduct in-depth evaluation of emission factors and methodologies in current operation
- co-operate with other international organisations working on emission inventories with the aim of harmonising methodologies and avoiding duplication of work.

The first meeting of the task force was held in London (UK) in 1992) and established eight expert panels to progress the work of the task force. The second meeting was held in Delft (Netherlands) in 1993 and agreed the specification for the joint EMEP/CORINAIR Emission Inventory Guidebook. The third meeting was held in 1994 in Regensburg (Germany) and reviewed first drafts of the Guidebook and considered how to integrate into the task force work previously developed by the task force on emission projections. The fourth meeting was held in 1995 in Oslo (Norway) and reviewed/assessed the second draft of the Emission Inventory Guidebook and considered how to develop the second phase of the Task Force. In 1995 the Executive Body agreed that the TFEI should continue beyond June 1995 and combine with the Task Force on Emission Projections to become the Task Force on Emissions Inventories and Projections (TFEIP). The subsequent meetings were held in 1996 in Oxford (UK) (5<sup>th</sup>), resulting in finalisation of the first edition of the Guidebook (EEA, 1996), in 1997 in Apeldoorn (Netherlands) (6<sup>th</sup>), in 1998 in Wismar (Germany) (7<sup>th</sup>) and in 1999 in Roskilde (Denmark) (8<sup>th</sup>), resulting in finalisation of the second edition of the Guidebook (EEA, 1999). Since then the TFEIP has met in Rome (Italy) in 2000 and in Geneva (Switzerland) in 2001, where revised EMEP reporting procedures were presented and discussed. Following this meeting the Task Force set up an editorial sub-group to revise and finalise these Guidelines, in response to comments received, for submission to the Steering Body. Following this the Steering Body adopted the new guidelines for estimating and reporting emissions data in principle for a pilot phase to allow Parties to apply them in the 2001 reporting round, while requesting the TFEIP to incorporate the comments made to the

extent possible, taking into account the comments made by National Experts and experience gained.

### 3.5 The IPCC/OECD/IEA Programme on National Greenhouse Gas Inventories

In February 1991 the OECD held a workshop in Paris on greenhouse gas emission inventory methodology to consider the OECD report 'Estimation of Greenhouse Gas Emissions and Sinks' (Background Report). The workshop produced (OECD, 1991) consensus on:

- a) a basic methodology document as the best available starting point for work on consistent national emission estimates and
- b) a proposed plan for a two-year programme of work to improve and disseminate the inventory methodology.

IPCC subsequently adopted the Work Programme to be carried out by IPCC Working Group 1 with support from OECD and IEA and recognised that method development effort should (IPCC, 1992):

- a) build on available information - both best available scientific data from ongoing research and currently available inventories and methods
- b) provide a simple default method accessible to all participating countries
- c) allow more detailed methods - those countries which have detailed emissions inventory capabilities should be encouraged to use them to provide the best possible data to the IPCC
- d) have careful documentation and review procedures to ensure consistency and transparency of results.

This Work Programme prepared Draft Guidelines for National Greenhouse Gas Inventories in three volumes - Reporting Instructions, Workbook and Reference Manual - in the six official languages of the United Nations for world-wide review during 1994. These guidelines were revised, updated and issued as a three volume set of Guidelines in early 1995 prior to the first Conference of the Parties held in Berlin in March-April 1995.

The Guidelines were revised in 1996 and 1997 through a series of expert workshops on agricultural soils, waste, new gases/industrial processes, land-use change and fuel combustion followed by a formal review process. This resulted in the three volume set "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories" (IPCC/OECD/IEA, 1997).

The Guidelines cover the main sources of the three major greenhouse gases - CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O - and three additional groups of greenhouse gases - HFCs, PFCs and SF<sub>6</sub> but also prompt for emission estimates from three ozone precursors - NO<sub>x</sub>, CO and NMVOC. Furthermore, it is likely that information may be requested on SO<sub>2</sub> and NH<sub>3</sub> (which are important in the formation of aerosols and hence cloud formation which may have a negative effect on global warming) and other greenhouse gases and precursors.

The IPCC Guidelines specifies six main sectors for reporting emissions and removals :

- All Energy (Combustion + Fugitive)
- Industrial Processes
- Solvent and other Product Use
- Agriculture
- Land Use Change and Forestry
- Waste.

The CORINAIR Technical Unit followed by the European Topic Centre on Air Emissions (ETC/AE) has been working closely with the IPCC/OECD/IEA to ensure compatibility between the joint EMEP/CORINAIR Atmospheric Emission Inventory Guidebook and reporting formats and the IPCC Guidelines and reporting formats. This was achieved by means of the preparation by ETC/AE of the revised SNAP97, distributed in 1998 and included in this Guidebook. SNAP97 is fully in line with the 1996 Revised IPCC Guidelines. Work to further harmonise EMEP and IPCC systems continues.

#### **4 MULTI-MEDIA INTEGRATED INVENTORIES**

##### *General*

In reviewing the requirements of the Fifth Environmental Action Programme (5EAP) 'Towards Sustainability' and developing the work programme for the EEA, the EEA Task Force has recognised the potential for extending the CORINAIR methodology to other media - a common, core set of relevant activity data would be collected and emission factors applied to these data to provide estimates of emissions or releases into all media - air, water and land - as well as waste.

An initial feasibility study carried out for the EEA-TF recommended that an integrated emission inventory should, in the long term, aim to:

- cover all the emittants relevant to the Fifth Environmental Action Programme
- cover emissions from both anthropogenic and natural sources
- include emissions to all the environmental media relevant to the Fifth Environmental Action Programme (air, surface waters, groundwaters, land)
- be capable of defining major point and line emission sources, as well as diffuse emissions
- be based upon a combined methodology of self-monitoring (for point sources) and centralised assessment (for non-point sources)
- be based on a modular structure, allowing data on emissions to be combined and aggregated by environmental medium, socio-economic activity/sector, product, geographic area etc according to need
- provide a survey of emissions on an annual cycle
- include rigorous procedures for data quality control and documentation
- provide support for access-by-request from *bona fide* users, including policy makers, scientists and public

- provide regular publications and summaries of results in an accessible form (including CD-ROM)
- be built upon the wide body of experience and data which already exist in member states and international agencies
- be managed to ensure that data are collated and stored at the most appropriate institutional level and that only data explicitly required at a European level need be transferred to the central co-ordinating agency
- be co-ordinated by the European Environment Agency with the support of a Topic Centre and national focal points.

To achieve these long-term aims, the report also recommended a number of steps to be taken, including

- the development of a conceptual model of emissions including sources, pathways and receiving media of concern
- development (in collaboration with Eurostat and other international statistics agencies) of a source classification, consistent with the general structure of the hierarchical NAPSEA nomenclature but covering other media and emission pathways and formally and explicitly linked to existing statistical classifications (for example NACE, ISIC, PRODCOM)
- development of a list of priority emittants
- definition of clear criteria for the identification and selection of point sources
- formulation of agreed reporting procedures
- definition of approved measurement methods
- establishment of a network of reporting agencies
- specification of inventory structure and database
- development of quality control procedures
- agreement on access conditions.

Finally, since an integrated inventory cannot be achieved in a single step, the report recommended that a phased approach should be adopted with piloting of some of the required features, as was carried out for CORINAIR with the 1985 inventory.

The feasibility study recognised a two-pronged strategy for developing integrated emission inventories, based on:

- the use of plant-specific information, where available from measurements, permits and registers developed for the purposes of emission abatement and control, and
- modelling emissions from appropriate activity data and emission factors for other sources.

This work is now continuing as part of the work programme of the European Environment Agency to progressively develop source-oriented inventories covering emissions to air, water and soil as well as waste releases and transfers.

### *IPPC Directive (PER)*

In 1996 the EC Directive on Integrated Pollution Prevention and Control was adopted (Directive 96/61/EC). The purpose is to achieve integrated prevention and control of pollution arising from activities listed in Annex 1 of the Directive, through permits to be issued by the Member States. In 1997 a Committee has been formed according to Article 19 of the IPPC Directive to establish the format and particulars of the “inventory of principal emissions and sources responsible” (so-called Polluting Emissions Register or PER) provided for in Article 15(3) of the Directive. This inventory is to be based on data supplied by member states to DGXI. DGXI is required to report this inventory on a 3-yearly basis to Council and Parliament with the first inventory expected to be reported in 2002.

In 1997, 1998 and 1999 several meetings of the Committee and additional working groups have been held to discuss issues such as the list of substances to be reported, the use of threshold values for reporting, the definitions of the reporting unit (e.g. industrial site), the source nomenclature to be used (for example the NOSE-P system developed by Eurostat, assisted by EEA. NOSE-P means Nomenclature of Sources of Emissions, Processes). The EEA could assist the Commission in the collection, management and/or presentation of the data (from member states), in co-operation with Eurostat. Final decisions on the European PER are expected in 1999 or 2000.

The results of the European PER could eventually be fed into a future EEA Integrated Emissions Inventory (IEI), that would consist of emissions to air and water and generation of waste from large point sources (meaning IPPC installations in the European PER) and diffuse or “area” sources (e.g. transport, agriculture, small enterprises).

### *OECD/PRTR*

The OECD has developed a guidance document for governments who are considering establishing a national pollutant release and transfer register (PRTR). The Guidance Manual for Governments, published in 1996 [OCDE/GD(96)32], was developed through a series of workshops which addressed the key factors countries should consider when developing a PRTR: why should a country establish a PRTR; what are the goals/objectives of the system and which chemical substances should be reported; how should the data be disseminated; and how should a PRTR system be implemented.

The OECD and the Environment Agency of Japan hosted in 1998 an international conference on Pollutant Release and Transfer Registers (PTRT). Representatives from 38 countries met in Tokyo to take stock of the progress and status of PRTRs world-wide and to discuss future directions for its use and design. The conference recommended that OECD countries should continue to set the example in implementing PRTRs and take the lead in sharing their experiences; that OECD should review its PRTR Guidance Manual for Governments and identify areas where supplemental policy and technical guidance might be needed to better share methodologies for estimating pollutant releases, verifying the data, standardising reports and comparing PRTR data across borders and using PRTRs to indicate cleaner technology and technology transfer opportunities; that international organisations should work together to

identify how a PRTR could be used to monitor commitments set forth in international environmental agreements; and that all countries without PRTRs should consider the initiation of a national system.

## **5 THE EUROPEAN ENVIRONMENT AGENCY**

The European Environment Agency was established by EC Regulation 1210/90 (updated in 1999 (Regulation 933/1999) and commenced operation in Copenhagen on 30 October 1993.

The overall objective of the Agency as specified in the Regulation is “to provide the European Community and the Member States with objective, reliable and comparable information at European level enabling them to take the requisite measures to protect the environment, to assess the results of such measures and to ensure that the public is properly informed about the state of the environment”.

The geographical scope of the Agency’s work is not confined to Member States of the EU; membership is open to other countries that share the concerns of the EU and member states and the objectives of the Agency. Current membership includes all 15 EU states, as well as Iceland, Liechtenstein and Norway (EEA18 countries). Furthermore EEA co-operates with Central and Eastern and other European countries.

An important product of the EEA is its regular State of the Environment report, for example the report “Europe’s Environment: The Second Assessment”, published in June 1998 as an update of “Europe’s Environment: the Dobris Assessment” (1995) and the report “Environment in the European Union at the turn of the century” (1999).

The second Multiannual Work Programme for 1999-2003 was adopted by the Management Board of the Agency in 1999. The Regulation specifies that the Agency shall furnish information which can be directly used in the implementation of Community environmental policy and that it should give priority to a number of areas including atmospheric emissions.

As part of the first work programme the Agency in December 1994 designated five European Topic Centres to address inland waters, marine & coastal environment, air quality, nature conservation and air emissions respectively for a first 3-yearly work period, which was extended for a second 3-year period in 1998, ending by 31 December 2000.



The European Topic Centre on Air Emissions (ETC/AEM) is led by the Umweltbundesamt (UBA), Germany supported by a consortium of partners involving:

- Umweltbundesamt (UBA), Austria
- Centre Interprofessionnel Technique de la Pollution Atmosphérique (CITEPA), France
- POSEIDON, Greece and
- the European Network of Environmental Research Organisations (ENERO, which includes - NETCEN, United Kingdom  
RISO, Denmark  
ENEA, Italy  
TNO, Netherlands).

The ETC/AE shall support national experts of EEA countries and ensure the delivery of high quality - reliable, comparable and timely - air emissions data relevant at the European level in the context of the EEA's mandate (EEA Regulation), objectives and work programme (EEA Annual Work Programme 2000 and Multi Annual Work Programme 1999-2003). Air emissions data are in particular required by EU legislation and the various international conventions and protocols. ETC/AE also contributes to the production of the main EEA state of the environment reports, where air emission estimates are needed for assessing the environmental problems climate change, ozone depletion, acidification, tropospheric ozone, dispersion of hazardous substances and urban air quality.

The main aim of the work programme of ETC/AE is to set up an annual European air emission inventory system (CORINAIR : CORE INventory of AIR emissions), including collecting, managing, maintaining and publishing the information, based on official national inventories (national total emissions, emissions by source sector, geographically distributed emissions).

ETC/AE assists participating countries to report their national emission inventories to the various international obligations in a consistent, transparent, complete and timely way, mainly by providing software and organising regular workshops. ETC/AE also checks to a limited extent national inventories before submission by the country, but the country is always responsible for the final official submission. ETC/AE makes available to participating countries a software package (CollectER, Collect Emission Register, and ReportER, June 1998) and a manual to enable the countries to report to all the international obligations. The software system makes use of the SNAP97 source nomenclature. In addition a software package with a report and a manual to estimate national emissions from road transport was made available (COPERT2, Computer Programme for estimating Emissions from Road Transport) to participating countries end of 1997 and a revised version in mid 1999 (COPERT3). COPERT3 includes most results from the DGVII (Directorate for Transport) programmes COST 319, the Estimation of Emissions from Transport, and MEET (Methodologies to Estimate Emissions from Transport).

Apart from the individual MS the European Community is also a Party to UNECE/CLRTAP and UNFCCC, requiring the European Community (Commission, DGXI) to report total EU15 emissions. ETC/AE is assisting the Commission in preparing these EU15 emission estimates as well as the necessary reports under the EC Monitoring Mechanism and to CLRTAP.

The ETC/AE has paid much attention the past years to reach full consistency between the CORINAIR and UNECE/CLRTAP/EMEP approach by developing jointly a emission source nomenclature SNAP97 (Selected Nomenclature for sources of Air Pollution) with CLRTAP/EMEP (the Co-operative Programme for Monitoring and Evaluation of the Long Range Transmission of Air Pollutants in Europe) and its Task Force on Emission Inventories and Projections (TFEIP). In addition the SNAP97 nomenclature has been made fully compatible with the source nomenclature used in by the IPCC (Intergovernmental Panel on Climate Change) for reporting by countries to UNFCCC. Work to further harmonise EMEP and IPCC systems continue.

Since October 1998 EEA and ETC/AE work closely together with the DGI PHARE programme, and a PHARE Topic Link on Air Emissions (PTL-AE). PTL-AE has a contract of 2 years to perform similar activities as ETC/AE in the 13 PHARE Central and Eastern European countries, as ETC/AE performs for EEA countries.

Over the period until 1999 the ETC/AE has prepared the following EEA reports:

- Review of CORINAIR 90 - Proposals for Air Emissions 94, *Topic Report 6 (1996)*;
- Recommendations for Revised Data System, *Topic Report 12 (1996)*;
- CORINAIR 90 : Summary Report no 1 (Sectors), *Topic Report 7 (1996)*;
- CORINAIR 90 : Summary Report no 2 (Sub-sectors) , *Topic Report 8 (1996)*;
- CORINAIR 90 : Summary Report no 3 (Large Point Sources), *Topic Report no. 20 (1996)*;
- Updated CORINAIR software and Instructions for Use (Version 1.01b), September 1996;
- Annual Summary Report 1995, *Topic Report no. 9 (1996)*;
- Review study on European Urban Emission Inventories, *Topic Report no. 20 (1996)*;
- CORINAIR94 inventory, *Topic Report no. 8 (1997)*;
- Annual Summary Report 1996, *Topic Report no. 6 (1997)*;
- Air Pollution in Europe, *EEA Environmental Monograph No. 4 (1997)*;
- COPERT2 Computer Programme to Calculate Emissions from Road Transport, Methodology and Emission Factors, software User Manual, *Technical Report No. 5 and No. 6 (1997)*;
- Annual Topic Update 1997, *Topic Report no. 8 (1998)*;
- COPERT3, Methodology and Emission Factors, software User Manual, *final draft July 1999*;
- CollectER and ReportER software (version 1.0), Installation, User Guide, Manual, *final draft April 1999*;
- Overview of national programmes to reduce greenhouse gas emissions, *Topic Report no. 8 (1999)*;

- Annual European Community Greenhouse Gas Inventory 1990-1996, *Technical Report no. 19 (1999)*;

In addition ETC/AE has made the results of the CORINAIR90 and CORINAIR94 emission inventories available on its web site and in addition has prepared a database with time series of aggregated emissions estimates for all EU Member States, that is available for public access on the EEA web site (EEA Data Warehouse).

See for more information the EEA and ETC/AE web sites:

<http://eea.eu.int>

<http://etc-ae.eionet.eu.int/etc-ae/index.htm>