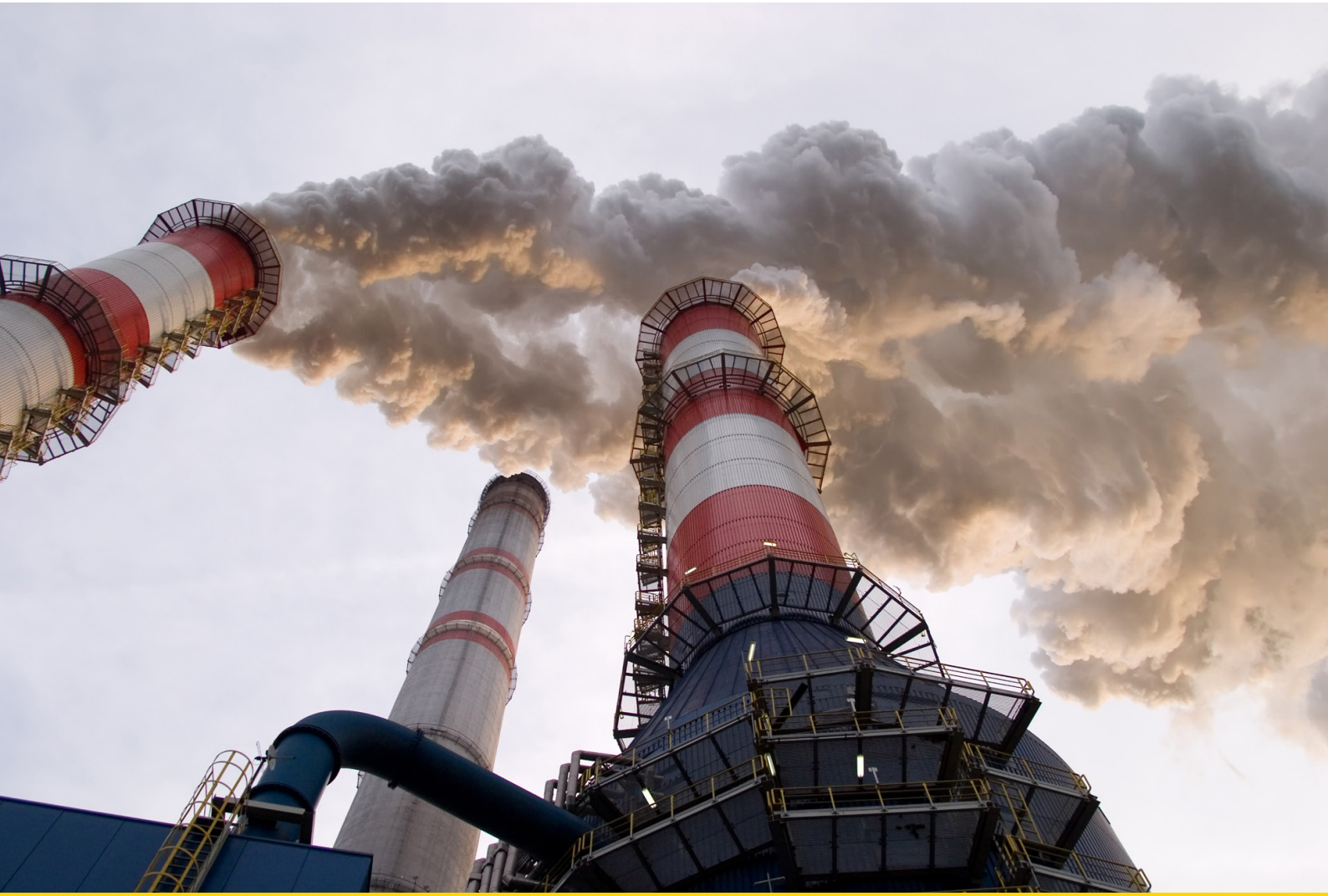
EEA Report | No 21/2016

EMEP/EEA air pollutant emission inventory guidebook 2016

Technical guidance to prepare national emission inventories

ISSN 1977-8449



LRTAP
Long-range Transboundary Air Pollution

European Environment Agency

EMEP/EEA air pollutant emission inventory guidebook 2016

Technical guidance to prepare national emission inventories

LRTAP Long-range Transboundary Air Pollution

European Environment Agency

Cover design: EEA
Cover photos: © Victor Troyanov, Environment & Me/EEA, 2014
Layout: EEA/Henriette Nilsson

Luxembourg: Publications Office of the European Union, 2016

ISBN 978-92-9213-806-6
ISSN 1977-8449
doi:10.2800/247535

European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

Contents

Part B: Technical chapters

Acknowledgements

The preparation and review of the 2016 EMEP/EEA air pollutant emission inventory guidebook (and earlier versions thereof) has been supported by many individuals, particularly those from the UNECE Task Force on Emission Inventories and Projections (TFEIP), the European Environment Information and Observation Network (Eionet) and several industry organisations. All experts who have contributed to the preparation and review of the current and past versions of the Guidebook are sincerely thanked.

In particular, much of the 2016 update was performed by a consortium led by Ricardo Energy and Environment, United Kingdom, within the scope of the project *Continued improvement of inventory methodologies* funded by the Directorate General (DG) Environment of the European Commission. The European Environment Agency provided funding for the update of a number of additional chapters in work performed by TNO and the Danish Centre for Energy and Environment, Aarhus University. Contributions in kind were received from TFEIP's expert panel leaders, Denmark and Germany which contributed to the update and finalisation of several further chapters. Further contributions from Concawe, Eurocontrol (funded by DG Climate Action of the European Commission), Eurometaux and European Aluminium are also acknowledged.

The following individuals were instrumental in the preparation of the updated 2016 Guidebook:

Technical coordinators

Stationary combustion:

Robert Stewart, Robert Whiting.

Mobile combustion and non-road mobile machinery:

Laurent Box, Laura Carbo, Chris Dore, Robin Deransy, Nuria Torres Meana, John Norris, Leonidas Ntziachristos, Mark Whiteley, Morten Winther.

Industrial processes, solvent and product use:

Peter Coenen, Stijn Dellaert, Patrik Fauser, Kevin Hausmann, Tatjana Kampffmeyer, Robert Kludt, Jeroen Kuenen, Antoon Visschedijk.

Agriculture:

Rikke Albrektsen, Barbara Amon, Chris Dore, Nick Hutchings, Beatriz Sanchez Jiménez, J. Webb, Jeremy Wiltshire, Sebastian Wulf.

Waste:

Jose Manuel Ramirez Garcia.

General guidance/cross-cutting:

Nadine Allemand, Mark Broomfield, Richard Claxton, Sabino Del Vento, Melanie Hobson.

EEA coordinator

Martin Adams.

Chapter authors

The names of lead/coordinating authors, and past and present authors of the individual Guidebook chapters are listed on the cover page of each respective chapter.

TFEIP co-chairs

Chris Dore (United Kingdom),

Martin Adams (European Environment Agency),

Kristina Saarinnen (Finland).

TFEIP expert panel leaders

Combustion and industry:

Carlo Trozzi and Jeroen Kuenen.

Agriculture and nature:

Barbara Amon, Nick Hutchings and Rainer Steinbrecher.

Transport:

Biagio Ciuffo, Riccardo Delauretis and Leonidas Ntziachristos.

Projections:

Nadine Allemand and Melanie Hobson.

Foreword

It gives us great pleasure to introduce the revised 2016 version of the 'EMEP/EEA air pollutant emission inventory guidebook'.

The Guidebook remains the most recognised set of emission inventory estimation methods used in air pollution studies in Europe and the wider UNECE geographical area. Importantly, it also continues to evolve over time, incorporating new information and science relevant for the purposes of air pollutant emission inventory compilation. The 2016 update of the Guidebook's set of methodologies will help ensure comparable and consistent emissions data are reported by countries, in turn helping inform policymakers, the scientific community and the broader public.

Earlier versions of the Guidebook have highlighted that sound policy implementation requires timely and reliable information. These requirements remain essential today. Ensuring the availability of high quality air pollutant emissions data is a key element in helping countries to better shape and define environmental priorities, improve air quality modelling, and assess the effectiveness of policy interventions in terms of protecting human health and the environment. High quality air pollutant emission inventory data is also needed to allow a robust monitoring of progress toward the future emission reduction commitments agreed in the 2012 amended Gothenburg Protocol to the LRTAP Convention, and for European Union Member States the additional commitments under the 2016 revised National Emission Ceilings Directive.

It is also timely to note that our scientific understanding will continue to evolve and that guidance on estimating emissions will necessarily require further updates in the future. Making quantitative assessments of the source contributions to air quality, and developing and implementing effective policies that reduce emissions remains a challenge, but must be no less of a priority for Europe and UNECE.

Finally, we would like to thank all experts who have contributed to the preparation and review of the updated Guidebook, particularly those from the UNECE/EMEP Task Force on Emission Inventories and Projections (TFEIP) and the European Environment Information and Observation Network (Eionet).

Professor Hans Bruyninckx
Executive Director
European Environment Agency

Dr Laurence Rouil
Chair
European Monitoring Evaluation Programme
UNECE LRTAP Convention

Preface from TFEIP chairs

Dear colleagues,

Welcome to the revised 2016 edition of the EMEP/EEA Air Pollutant Emission Inventory Guidebook.

The work on the original *EMEP Corinair Guidebook* started in 1992 and it has since been developed and maintained by the UNECE/EMEP Task Force on Emission Inventories and Projections (TFEIP) under the Convention on Long Range Transboundary Air Pollution (LRTAP Convention). The Guidebook continues to be published by the European Environment Agency (EEA) www.eea.europa.eu/emep-eea-guidebook.

Much of the work performed as part of this 2016 update was funded by the European Union (supported by the European Commission and European Environment Agency). Other chapters were updated with the support from the TFEIP's expert panel leaders, as well as via contributions in kind from experts from Denmark and Germany. This 2016 version of the Guidebook has undergone review by experts from the Task Force, EEA's Environment Information and Observation Network (Eionet) and industry stakeholders, and all comments received during the review have been considered and used in the development of the updated version.

More specifically, important updates have been made in the following areas:

- consistency of particulate matter (PM) emission factors, including identification of whether these represent filterable or condensable PM fractions;
- small combustion sources guidance;
- non-road mobile machinery sources guidance;
- agriculture sources guidance, including from manure management, crop production and agricultural soils, and ammonia emissions from biogas production;
- metal emissions from refineries;
- non-ferrous metal sources guidance;
- domestic and other solvent use guidance;
- aviation sources guidance;
- construction and demolition sources guidance.

The updated guidebook remains structured according to the revised Nomenclature For Reporting (NFR) as defined in the 2014 'Guidelines for reporting emissions and projections data under the Convention on Long-range Transboundary Air Pollution' (ECE/EB.AIR/125). The NFR reporting nomenclature is consistent with the format to be used for reporting of greenhouse gas emission inventories under the United Nation Framework Convention on Climate Change (UNFCCC), but expanded for particular sources of air pollution.

The Guidebook is intended as a general reference source. In particular it is used in conjunction with the LRTAP Convention reporting guidelines, and by European Union Member States for reporting under the National Emission Ceilings Directive. The Guidebook also remains the recommended source of methodology information for preparing emission inventories of indirect greenhouse gases (i.e. ozone precursors and sulphur dioxide) following the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. Furthermore, the Guidebook is also frequently used as a reference document by researchers. As such it remains the most influential set of emission estimation methods used in air pollution studies in Europe and elsewhere.

Finally, we would like to warmly thank the various funding bodies, the individuals and organisations that undertook the latest update, and all the numerous experts from TFEIP, Eionet and industry groups who provided comments concerning earlier draft versions.

Chris Dore (United Kingdom)
Martin Adams (European Environment Agency)
Kristina Saarinen (Finland)
Co-chairs of the Task Force on Emission Inventories and Projections responsible for the 2016 update of the EMEP/EEA Air Pollutant Emission Inventory Guidebook

1 Guidebook introduction

Lead author: Martin Adams

Contributing authors (including to earlier versions of this chapter): Kristin Rypdal, Mike Woodfield

1.1 Introduction

The joint EMEP ([1])/EEA Air Pollutant Emission Inventory Guidebook (the 'Guidebook'), following the 'Guidelines for Reporting Emissions and Projections Data' under the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (LRTAP) ([2]), provides concise guidance on how to compile an atmospheric emissions inventory. The Guidebook has been prepared by the Convention's Task Force on Emission Inventories and Projections (TFEIP), with detailed work by the Task Force's expert panels and the European Environment Agency (EEA) ([3]). The Guidebook is published by the EEA and the present edition replaces all earlier versions. This updated version of the Guidebook is compatible with, and complementary to, the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereafter the IPCC Guidelines).

The present version has been updated but reproduces information from earlier editions to the extent that this continues to be relevant. More specifically, the 2016 version of the Guidebook presents a number of important improvements and updates, including in the following areas:

- consistency of particulate matter (PM) emission factors, including identification of whether these represent filterable or condensable PM fractions;
- small combustion sources guidance;
- non-road mobile machinery sources guidance;
- agriculture sources guidance, including from manure management, crop production and agricultural soils, and ammonia emissions from biogas production;
- metal emissions from refineries;
- non-ferrous metal sources guidance;
- domestic and other solvent use guidance;
- aviation sources guidance;
- construction and demolition sources guidance.

General guidance sections continue to introduce the principles of preparing inventories; these are intended to help users identify the areas where improvements would be most beneficial so that limited resources can be focused to best advantage.

The Guidebook also continues to follow the example of the IPCC Guidelines in providing decision trees to assist inventory compilers make the most appropriate methodological choice, taking into account data availability and the importance of the source.

Note 1

Air pollutant inventories and greenhouse gas (GHG) inventories are different in a number of important ways; air pollutant inventories, in particular, need to take into account emission abatement, and more of the emission-related information is derived from facility reporting.

([1]) Cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP) is a scientific body established under the Convention on Long-range Transboundary Air Pollution.
([2]) The LRTAP Convention Reporting Guidelines and the associated annexes are available online from the EMEP Centre on Emission Inventories and Projections (CEIP) website http://www.ceip.at).
([3]) See Section 1.7 for more information on these bodies.

The present Guidebook is structured according to the Nomenclature for Reporting (NFR), which was first developed in 2001–2002 by the Convention's TFEIP, further improved in 2006–2007, and revised again in 2013/2014 as part of the revision of the LRTAP Reporting Guidelines. Changes to the NFR structure since 2001 have ensured a continuing consistency with the IPCC source nomenclature developed for reporting greenhouse gases under the UN Framework Climate Change Convention. Cross-referencing to the Selected Nomenclature for reporting of Air Pollutants (SNAP) 97 originally developed by the EEA's European Topic Centre on Air Emissions (ETC/AE) is included.

1.2 Scope

The Guidebook has two key functions:

- to provide procedures to enable users to compile emission inventories that meet quality criteria for Transparency, Consistency, Completeness, Comparability and Accuracy (TCCCA criteria);
- to provide estimation methods and emission factors for inventory compilers at various levels of sophistication.

The Guidebook may be used for general reference or, in conjunction with the LRTAP Reporting Guidelines, by Parties to the Convention to assist them, in meeting their emission reporting obligations under the Convention and its protocols ([4]). It must also be used by the Member States of the European Union to fulfil their emissions reporting requirements under the National Emission Ceilings (NEC) Directive ([5]).

The Guidebook may be used to prepare emission inventories of the substances which, if emitted into the atmosphere as the result of human and natural activity, are implicated in:

- acidification, eutrophication, and photochemical pollution;
- air quality degradation;
- damage and soiling of buildings and other structures;
- human and ecosystem exposure to hazardous substances.

Inventories prepared according to the Guidebook are suitable for:

- providing information to policymakers in UNECE countries and the Member States of the European Union, the EEA, the Convention and its Parties, the Convention's implementation committee and the public;
- defining environmental priorities and identifying the activities responsible for the problems;
- setting explicit objectives and constraints;
- assessing the potential environmental impacts and implications of different strategies and plans;
- evaluating the environmental costs and benefits of different policies;
- monitoring the state of the environment to check that targets are being achieved;
- monitoring policy action to ensure that it is having the desired effects;
- ensuring that those responsible for implementing policies make sure that their governments are complying with their obligations. Under the Convention, the national emission inventories allow the Implementation Committee to effectively assess compliance by Parties with their emission obligations under the protocols and report on cases of non-compliance to the Executive Body of the Convention.

The Guidebook does not provide guidance on the estimation and reporting of emissions of the direct gases responsible for global warming and climate change. These are included in the separate IPCC Guidelines. If substances are implicated in both climate change and regional pollution then cross-referencing is provided in the most appropriate specific guidance.

([4]) Parties must submit data annually to the EMEP Centre on Emission inventories and Projections (CEIP (http://www.ceip.at/ceip/) and inform the UNECE secretariat of the contents of their data submission.

([5]) Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants (the NEC Directive), OJ L 309, 27.11.2007, p. 22. A revision of the NEC Directive was agreed in mid-2016 but at time of writing has not yet been published in the European Union's Official Journal.

The Guidebook also does not provide guidance on the estimation and reporting of emissions of gases responsible for stratospheric ozone depletion.

1.3 Concepts

Inventory compliers rely on the key concepts outlined below to ensure that inventories are comparable between countries, do not contain double counting or omissions, and that the time series reflect actual changes in emissions.

Accuracy

'Accuracy' means that emission estimates should be accurate in the sense that they are systematically neither over nor under true emissions, as far as can be judged, and that uncertainties are reduced as far as practicable.

Comparability

'Comparability' means that estimates of emissions reported by Parties in their inventories should be comparable. For that purpose, Parties should use the accepted methodologies as elaborated in the Reporting Guidelines and the NFR formats for making estimations and reporting their inventories.

Completeness

'Completeness' means that an annual inventory covers at least all sources, as well as all pollutants, for which methodologies are provided in the latest EMEP/EEA air pollutant emission inventory guidebook or for which supplementary methodologies have been agreed to by the Executive Body. Completeness also means the full geographical coverage of the sources of a Party. Where numerical information on emissions under any source category is not provided, the appropriate notation key defined in the Reporting Guidelines should be used when filling in the reporting template and their absence should be documented.

Consistency

Consistency' means that an annual inventory should be internally consistent for all the reported years for all elements across sectors, categories and pollutants. An inventory is consistent if the same methodologies are used for all of the years of the inventory and if consistent data sets are used to estimate emissions. For projections, consistency also means that a year of the submitted inventory is used as a base year.

Decision trees

Decision trees, for each category, help the inventory compiler navigate through the guidance and select the appropriate tiered methodology for their circumstances based on their assessment of key categories. In general, it is good practice to use higher tier methods for key categories, unless the resource requirements to do so are prohibitive.

Good practice

In order to promote the development of high-quality inventories a collection of methodological principals, actions and procedures have been defined and collectively referred to as good practice. Inventories consistent with good practice are those that contain neither overestimates nor underestimates, so far as can be judged, and in which uncertainties are reduced as far as practicable. (NB the 2006 IPCC Guidelines refined the concept of good practice and these are reflected in the Guidebook.)

Inventory year and time series

National inventories contain estimates for the calendar year during which the emissions to the atmosphere occur. Where suitable data to follow this principle are missing, emissions may be estimated using data from other years applying appropriate methods such as averaging, interpolation and extrapolation. A sequence of annual inventory estimates (e.g. each year from 1990 to 2016) is called a time series. Given the importance of tracking emissions trends over time, countries should ensure that a time series of estimates is as consistent as possible.

Inventory reporting

Inventory reporting consists of the submission of a set of standard reporting tables for specified substances, for the requisite source, for a given reporting year. The LRTAP Reporting Guidelines provide standardised reporting tables, but the content of the tables and written report may vary according to, for example, a country's obligations as a signatory to individual Convention protocols.

Key category

A key category means a source category of emissions that has a significant influence on a Party's total emissions in terms of the absolute level of emissions of a given substance the trend in emissions over a given time period or the uncertainty in the estimates for that Party. The concept of key categories is an important aspect in inventory development in that it helps to identify priorities for resource allocation in data collection and compilation, quality assurance/quality control and reporting.

Pollutants

The Guidebook is designed to cover all the substances that Parties to the Convention's protocols need to report, plus a number of additional substances for which reporting is voluntary as defined in the LRTAP Reporting Guidelines.

Note 2

The LRTAP Reporting Guidelines list all the substances for which there are existing emission reporting obligations. The guidelines and annexes are available online from the CEIP website (www.emep-emissions.at).

Note 3

The European Union, as with all EU Member States, is a Party to the Convention and to most of its protocols.

Sectors, categories, and sources

Pollutant emissions estimates are divided into sectors — groupings of related processes and sources — these include:

- energy;
- industrial processes and product use;
- agriculture;
- waste;
- other.

Each sector comprises individual categories (e.g. transport) and subcategories (e.g. passenger vehicles). Ultimately countries will construct an inventory from the subcategory (source) level because this is the level at which data tends to be available and total emissions will be calculated by summation. A national total is calculated by the summation of emissions for each pollutant and category as defined in the respective reporting requirements. An exception is for so-called 'memo-items', those sources which following political agreement are not included in included in national totals (which may be used to assess compliance with protocol requirements), but which are reported separately. An example of a memo-item includes the emissions caused by fuel combustion from international shipping.

Tiers

A tier represents a level of methodological complexity. Usually three tiers are provided; Tier 1 is the simple (most basic) method; Tier 2, the intermediate; and Tier 3, the most demanding in terms of complexity and data requirements. Tiers 2 and 3 are sometimes referred to as higher tier methods and are generally considered to be more accurate.

Transparency

'Transparency' means that the data sources, assumptions and methodologies used for an inventory should be clearly explained, in order to facilitate the replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of the information. The use of the Nomenclature For Reporting (NFR) tables and the preparation of a structured Informative Inventory Report (IIR) contribute to the transparency of the information and facilitate national and international reviews.

Note 4

The use of the same methods and data sources throughout, provided there have been no recalculations, should be sufficient to ensure transparency. Parties should document any recalculated estimates. Generally, Parties should be able to explain inventory trends for each category, giving particular attention to outliers, trend changes, and extreme trends.

1.4 How to use the Guidebook

1.4.1 Guidebook structure

The Guidebook is structured to provide the user with general information on the basic principles of constructing an emissions inventory and the specific estimation methods and emission factors to compile one.

General guidance is given on:

- key category analysis and methodological choice;
- data collection (including measurement methodologies);
- time series consistency;
- uncertainties;
- inventory management, improvement and quality assurance/quality control (QA/QC);
- spatial emissions inventories;
- projections.

Specific guidance is ordered according to the NFR source categories and is cross-referenced to the SNAP process-based classification. The textual information provides a source description (including a general description about technologies and abatement technologies in use), guidance on methodological choice (including decision trees) and tier-based emission determination methods.

Note 5

Each chapter follows a structure consistent with the IPCC Guidelines supplemented with additional guidance on gridded data.

1.4.2 Guidebook methodology

It is impractical to measure emissions from all the sources that, together, comprise an emissions inventory. Consequently, the most common estimation approach is to combine information on the extent to which a human activity takes place (called activity data or AD) with coefficients that quantify the emissions or removals per unit activity, called emission factors (EF). The basic equation is therefore:

$$\text{Emissions} = \text{AD} \times \text{EF}$$

In the energy sector, for example, fuel consumption would constitute activity data and mass of sulphur dioxide emitted per unit of fuel consumed would be an emission factor. The basic equation can, in some circumstances, be modified to include other estimation parameters than emission factors, for example, to accommodate the effects of additional, secondary, abatement.

The Guidebook describes a tiered methodology for estimating emissions. Simple (Tier 1) methods are given for all the sources and substances which the countries that have ratified Convention protocols need to report. More advanced (Tier 2) methods are given for key categories. Further information is given for advanced (Tier 3) approaches for key categories where suitable methods are available.

- **Tier 1 methods** apply a simple linear relation between activity data and emission factors. The activity data is derived from readily available statistical information (energy statistics, production statistics, traffic counts, population sizes, etc.). The default Tier 1 emission factors are chosen in way that they represent 'typical' or 'averaged' process conditions — they tend to be technology independent.
- **Tier 2 methods** use the same or similar activity data to Tier 1 methods, but apply country-specific emission factors; country-specific emission factors need to be developed, using country-specific information on process conditions, fuel qualities, abatement technologies, etc. In many cases these methods could also be applied at a higher level of detail, where the activity statistics are further split into sub-activities with more or less homogenous process characteristics.

- **Tier 3 methods** go beyond the above; these may include using facility level data and/or sophisticated models. Examples might include the use of PRTR data or data from emission trading schemes for industrial emissions or models like COPERT for road transport emissions.

Wherever possible, an estimate has been made of the uncertainty that can be associated with both the emissions factors and the activity statistics quoted.

1.5 When to use the Guidebook

The Guidebook is intended to assist Parties to the Convention in meeting their emission reporting obligations under the Convention and its protocols and the Member States of the European Union to fulfil their emissions reporting requirements under the NEC Directive. In addition the Guidebook may be used to report some pollutants of relevance to the UN Framework Climate Change Convention (UNFCCC) and to other international bodies.

1.5.1 Reporting under the Convention on Long-range Transboundary Air Pollution

Reporting of emission data is required in order to fulfil obligations regarding the general requirements of the Convention and the more specific reporting requirements under the protocols under the Convention. The protocols with reporting requirements are:

- the 1985 Helsinki Protocol on the reduction of sulphur emissions or their transboundary fluxes;
- the 1988 Sofia Protocol concerning the control of emissions of nitrogen oxides or their transboundary fluxes;
- the 1991 Geneva Protocol on the control of emissions of volatile organic compounds or their transboundary fluxes;
- the 1994 Oslo Protocol on further reduction of sulphur emissions;
- the 1998 Aarhus Protocol on heavy metals and its 2012 amended version;
- the 1998 Aarhus Protocol on persistent organic pollutants and its 2009 amended version;
- the 1999 Gothenburg Protocol to abate acidification, eutrophication and ground-level ozone, and its 2012 amended version.

The reporting requirements under these protocols are described in the LRTAP Reporting Guidelines.

Parties to the Convention may use the Guidebook both as a reference book on good emission estimation practice and as a checklist to ensure that all relevant activities are considered and their emissions quantified. The Guidebook indicates that Parties are requested to document in a transparent manner in their inventory report where the Guidebook methodology has and has not been used. If another methodology has been used, the Parties are requested to provide additional explanatory information.

1.5.2 Reporting to the European Union

The 2016 revised version of NEC Directive sets upper limits for each Member State of the European Union for the total emissions in 2010, 2020 and 2030 of five main substances responsible for acidification, eutrophication, particulate matter formation (for 2020 and 2030 only) and ground-level ozone pollution: sulphur dioxide (SO_2); nitrogen oxides (NO_x); fine particulate matter ($PM_{2.5}$), non-methane volatile organic compounds (NMVOCs); and ammonia (NH_3). As the substances concerned are transported in large quantities across national boundaries, individual countries could not, in general, meet the underpinning objectives of the NEC Directive to protect human health and the environment within their territory by national action alone.

With regard to establishing and reporting emission inventory data, the NEC Directive specifies that countries shall prepare and annually update national emission totals for the pollutants SO_2, NO_x, NMVOCs, $PM_{2.5}$, NH_3 and other pollutants for which the European Union is obliged to report to the LRTAP Convention, as well as emission projections, gridded and large point source (LPS) data. Member States shall each year report the required information to the Commission and European Environment Agency. Data reported by Member States under the NEC Directive is compiled and made available through the website of the EEA's Data Service (http://dataservice.eea.europa.eu).

To help ensure harmonised and consistent emission information is reported, the NEC Directive requires all Member States to establish emission inventories using the methodologies agreed under the LRTAP Convention and to use the Guidebook in preparing these inventories and projections.

1.5.3 Other reporting

The Guidebook also facilitates reporting under a number of other international agreements.

Reporting under the UNFCCC

All Parties to the UNFCCC and the Kyoto Protocol shall 'develop, periodically update, publish and make available to the Conference of the Parties ... ... 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'. Consequently, Parties are required to annually report emissions and sink (and any recalculations that have occurred) of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) using the IPCC Guidelines for National Greenhouse Gas Inventories for estimating national inventories of anthropogenic emissions by sources and removals by sinks of greenhouse gases.

Parties should also provide information on emissions of carbon monoxide (CO), nitrogen oxides (NO_X) and non-methane volatile organic compounds (NMVOCs) and are encouraged to provide information of emissions of sulphur oxides (SO_2).

The IPCC Guidelines contain links to information on methods, used under other agreements and conventions, for the estimation of emissions of tropospheric precursors which may be used to supplement the reporting of emissions and removal of greenhouse gases for which methods are provided here. Volume 1, Sections 7.1 and 7.2, for example, refers inventory developers to the EMEP/CORINAIR Guidebook (now this EMEP/EEA Air Pollution Emission Inventory Guidebook) for the purpose of estimating emissions of sulphur dioxide (SO_2); carbon monoxide (CO); nitrogen oxides (NO_X); ammonia (NH_3) and non-methane volatile organic compounds (NMVOCs).

Reporting to the EU greenhouse gas monitoring regulation

Within the European Union, the 2013 Regulation on a Mechanism for Monitoring and Reporting Greenhouse Gas Emissions Greenhouse Gas Monitoring Mechanism ([6]) is used to monitor anthropogenic greenhouse gas emissions not controlled by the Montreal Protocol. It is also used to transpose related requirements under the UNFCCC and Kyoto Protocol into EU legislation and to evaluate progress towards meeting international and internal EU greenhouse gas reduction commitments.

The Regulation provides for the harmonisation and reporting of emission inventory and projections information at Member State and Union level. Article 7(1)(b) requires Member States to determine and report 'data... on their anthropogenic emissions of carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen oxides (NO_X) and volatile organic compounds (VOC), consistent with data already reported pursuant to Article 7 of Directive 2001/81/EC [the NEC Directive] and the UNECE Convention on Long-range Transboundary Air Pollution'. Since no further guidance is given on how to do so, by extension, the Guidebook may be used.

Multimedia inventories

The Guidebook may be of value to countries preparing source-oriented inventories that cover emissions made to various media including releases to air, water and soil and/or waste releases and transfers. Such multimedia inventories are commonly referred to as Pollutant Release and Transfer Registers (PRTRs). Internationally, the Kiev Protocol (to the UNECE Aarhus Convention) on pollutant release and transfer registers establishes PRTR requirements for Parties. The Organisation for Economic Cooperation and Development (OECD), in close cooperation with the United Nations Institute for Training and Research (UNITAR) and United Nations Environment Programme (UNEP) Chemicals, has also, for a number of years, run a PRTR programme providing guidance to countries interested in establishing a PRTR. Within the European Union, two such initiatives covering multimedia releases are the European Pollutant Emissions Register

([6]) Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC, OJ L165, 18.6.2013, p.13.

(EPER) and the European Pollutant Release and Transfer Registers (E-PRTR).

UNECE Aarhus Convention: Kiev Protocol on pollutant release and transfer registers

The Kiev Protocol has the objective 'to enhance public access to information through the establishment of coherent, nationwide pollutant release and transfer registers (PRTRs)'. Although the protocol does not directly regulate pollution from emitting sources, it does ensure that there is public access to information concerning the amount of pollution released from such sources. Having such information publicly available is expected to exert a significant downward pressure on levels of pollution.

Under the protocol, PRTRs developed by Parties should be based on a reporting scheme that is mandatory, annual and covers multimedia releases (air, water, land) as well as transfers of waste and wastewater. PRTRs should:

- be publicly accessible and searchable through the Internet;
- cover releases and transfers of at least 86 substances covered by the protocol;
- cover releases and transfers from certain types of major point source (e.g. thermal power stations, mining and metallurgical industries, chemical plants, waste and wastewater treatment plants, paper and timber industries);
- accommodate available data on releases from diffuse sources (e.g. transport and agriculture);
- allow for public participation in its development and modification.

Following the adoption of the protocol, a working group on PRTRs was established to prepare for the entry into force of the protocol. The working group has the mandate of assisting Parties to the Aarhus Convention prepare for the protocol's implementation, by the preparation of guidance documents, sharing information and experiences, etc.

OECD/PRTR

For a number of years, the OECD has supported countries 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; how should a PRTR system be implemented.

Based on the recommendation of a workshop held in Canberra, Australia, on Release Estimation Techniques (RETs), a task force on pollutant release and transfer registers was established in 2000, which is part of the OECD's Environment, Health and Safety programme. Its main tasks being to continue to improve RETs and make them widely available, to facilitate the sharing and comparing of PRTR data between countries, to advance and improve the use of PRTR data and to identify, analyse and develop tools and provide guidance to promote PRTR establishment. In 2005 the task force was merged with the Inter-Organisation programme for the sound Management of Chemicals (IOMC) PRTR coordination group and is now called the PRTR coordination task force. Useful products so far are a resource centre created by Environment Canada and a PRTR portal (www.PRTR.net) providing links with international and national PRTR activities and information sources. Information is also provided on quality control methods, methodology for estimating emissions from small and medium-sized enterprises, emissions from product use, and links between emissions and statistical data like national product or number of inhabitants.

The European Pollutant Release and Transfer Register (E-PRTR)

E-PRTR is the European Union's European pollutant release and transfer register. The EPRTR, based on Regulation (EC) No 166/2006 ([7]), succeeded the European Pollutant Emission Register (EPER) and fully implements the obligations of the UNECE

([7]) Regulation (EC) No 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European pollutant release and transfer register, OJ L 33, 4.2.2006, p. 1.

PRTR Protocol. The E-PRTR has a wider and more comprehensive scope than; it goes beyond the requirements of the protocol, covering more pollutants with stricter thresholds. It covers more than 91 substances released to air and water from industrial installations in 65 different sectors of activity; it will also include transfers of waste and wastewater from industrial facilities to other locations as well as data on emissions caused by accidents on-site. One important further difference is that data on releases from diffuse sources (such as road traffic, agriculture, domestic heating, shipping, etc.) is included.

The first reporting year under the E-PRTR was 2007; this data was reported by the Member States in June 2009 and made available to the public by the European Commission and EEA later that year. Since that year, annual updates of the data are available.

To assist countries in preparing for the implementation of the E-PRTR, the Commission, in cooperation with the Member States and other stakeholders, has published a guidance document for implementation of the E-PRTR in a number of languages (http://prtr.ec.europa.eu/#/downloadguidance).

1.6 Guidebook management

Maintaining the Guidebook is the responsibility of the TFEIP ([8]). It is published by the EEA.

1.6.1 Mandate of the sectoral expert panels of the TFEIP

The expert panels are ad hoc groups established by the TFEIP. There are currently three sectoral expert panels:

- Combustion and Industry
- Transport
- Agriculture and Nature.

In addition, there is one expert panel dealing with cross-cutting issues, the Expert Panel on Projections.

TFEIP has defined the role of the sectoral panels as:

- to collect and review available information on activities, emission factors and inventory methodology (emission estimates, emission factors, activity statistics, etc.) within the sector;
- to consider the significance of each source in terms of its contribution to emissions, the need to subdivide or merge source categories and to identify where new sources categories need to be added;
- to update the Guidebook to reflect developments within the sector (e.g. appearance of new technologies);
- to update the methodologies within the Guidebook when new knowledge concerning the processes driving emissions becomes available;
- to update emission factors within the Guidebook in the light of new emission measurements;
- to gather feedback and answer queries concerning the Guidebook from inventory compilers or from the Expert Panel on Review;
- to identify the need for further research or study to improve the methodology;
- to encourage the exchange of information between experts.

Maintenance of the technical content of the Guidebook is the responsibility of the TFEIP expert panels.

Note 6

Queries or offers of contributions to the technical work of the expert panels may be made by contacting the relevant expert panel leader. Names and contact details for the respective expert panel leaders are provided through the expert panel link on the website of the TFEIP (http://tfeip-secretariat.org).

([8]) The Task Force has assigned the detailed work to its expert panels which report their results to the Task Force.

1.7 Additional information

1.7.1 Historical context

Overview

The Convention on Long-range Transboundary Air Pollution was adopted in 1979. The convention, negotiated under the auspices of UNECE, was the first international environment agreement to address the threat of air pollution to human health and the environment. The Cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP) is responsible for providing the Parties to the Convention with information on the deposition and concentration of air pollutants, as well as on the quantity and significance of the long-range transmission of air pollutants and fluxes across boundaries. In providing this information EMEP is supported by various task forces; the Task Force on Emission Inventories and Projections (TFEIP), established by the Executive Body to the Convention, as the Task Force on Emissions, in 1991, is a technical forum for the exchange of information and the harmonisation of emission inventories — including emissions factors, methodologies and guidelines.

The European Council of Ministers established the CORINE (Co-oRdination d'Information Environnementale) work programme in 1985. Subsequently, the European Environment Agency task force created CORINAIR, an inventory of emissions of air pollutants in Europe, the Agency's European Topic Centre on Air and Climate Change later took over the coordination of this work.

TFEIP is today responsible for the technical content and EEA for hosting the EMEP EEA Guidebook. The Guidebook now contains the most influential set of emission estimation methods used in air pollution studies in Europe and the UNECE geographical area. It has evolved over a long period and has become an essential tool for compiling air emissions inventories to be reported under the LRTAP Convention protocols and the NEC Directive.

CORINAIR and the EEA task force

Council Decision 85/338/EEC ([9]) established a work programme concerning an 'experimental project for gathering, coordinating 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 included 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 coordinated inventory of atmospheric emissions from the 12 Member States of the Community in 1985 (CORINAIR 1985).

The CORINAIR 1985 inventory covered three substances — SO_2, NO_X, and VOCs — 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 — Nomenclature for Air Pollution Socioeconomic Activity (NAPSEA) and Selected Nomenclature for Air Pollution (SNAP) — for emission source sectors, sub-sectors and activities;
- a default emission factor handbook;
- a computer software package for data input and the calculation of sectoral, regional and national emission estimates.

The CORINAIR 1985 inventory was developed in collaboration with the countries, Eurostat, OECD and LRTAP/EMEP. The inventory was completed in 1990 and the results published (Eurostat, 1991; CEC, 1995) and distributed in tabular and map forms. It was agreed in 1991 to produce an update to CORINAIR 1985 (CORINAIR 1990). This update was performed in cooperation with both EMEP and IPCC-OECD to assist in the preparation of inventories required under the LRTAP Convention and the UN Framework Climate Change Convention (UNFCCC) respectively.

The CORINAIR90 system was made available to the:

- then 12 Member States of the European Community in 1990: Belgium, Denmark, Germany, Greece, France, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom;

([9]) Council Decision 85/338/EEC of 27 June 1985 on the adoption of the Commission work programme concerning an experimental project for gathering, coordinating and ensuring the consistency of information on the state of the environment and natural resources in the Community, OJ L 176, 6.7.1985, p. 14.

- then five EFTA countries: Austria, Finland, Norway, Sweden and Switzerland;
- three Baltic States: Estonia, Latvia and Lithuania;
- central and eastern European countries: Albania, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia;
- 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 substances to be covered to eight (SO_2, NO_X, NMVOC, NH_3, CO, CH_4, N_2O and CO_2);
- extended the number of sources to be considered as point sources (there were over 1 400 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 timescale to serve the requirements of the user community (policymakers, researchers, etc.).

The CORINAIR 1990 inventory recognised 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 were provided on large point sources on an individual basis and on other, smaller or more diffuse sources, on an area basis (usually by administrative boundary at the county, department level (NUTS level 3)). The sources provided as point sources were:

- power plants with thermal input capacity ≥ 300 MW;
- refineries;
- sulphuric acid plants;
- nitric acid plants;
- integrated iron/steel with production capacity > 3 Mt/yr;
- paper pulp plants with production capacity > 100 kt/yr;
- large vehicle paint plants with production capacity > 100 000 vehicles/yr;
- airports with > 100 000 landing and take-off (LTO) cycles/yr;
- other plants emitting ≥ 1 000 t/yr SO_2, NO_X or VOC or ≥ 300 000 t/yr CO_2.

The goal of CORINAIR90 was to provide a complete, consistent and transparent air pollutant emission inventory for Europe in 1990 within a reasonable timescale to enable widespread use of the inventory for policy, research and other purposes. Data from CORINAIR90 was finalised and published by the EEA (see under Section 1.5) in 1996 and 1997.

CORINAIR90 was followed by CORINAIR94, an expanded European air emission inventory for 1994 prepared by the EEA and its then European Topic Centre on Air Emissions (ETC/AE). In 1995 the ETC/AE developed the CORINAIR94 methodology and software, which were made available to the 18 EEA member countries and other interested countries (e.g. Malta, Switzerland) in January 1996 and to 13 central and eastern European countries in June 1996. Based on the submitted emission estimates from the countries, a final report describing the assessment was published by EEA in 1997.

The CORINAIR Technical Unit, followed by the European Topic Centre on Air Emissions (ETC/AE), worked closely with the IPCC, OECD and International Energy Agency (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 fully in line with the 1996 revised IPCC Guidelines.

EMEP and the Task Force on Emission Inventories and Projections (TFEIP)

The Cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP) (funded in part through the 1984 EMEP Protocol to the LRTAP Convention) arranged a series of workshops on emission inventory techniques to develop guidance for estimation and reporting of emission data for SO_X, NO_X, NMVOCs, CH_4, NH_3 and CO under the Convention. The 1991 workshop recommended 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 guidance proposed by the workshop for estimating and reporting to the Executive Body of the Convention. The guidance 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 Task Force on Emission Inventories (TFEI) was established in December 1991 by agreement of the Executive Body to the LRTAP Convention. The task force reported to the EMEP Steering Body and was led by the United Kingdom with support from Germany and the then European Community (including the EEA). In 1995, the Executive Body agreed that TFEI should be merged with the Task Force on Emission Projections to form the Task Force on Emissions Inventories and Projections (TFEIP).

Between 2004 and 2008, TFEIP was led by Norway and its activities supported by the other Parties to the Convention including the European Community, through the European Commission and the European Environment Agency (EEA). In September 2008, following the approval of the EMEP Steering Body, the United Kingdom again resumed the lead-country responsibilities for TFEIP (http://tfeip-secretariat.org).

The TFEIP provides a technical forum and expert network to harmonise emission factors, establish methodologies for the evaluation of emission data and projections and identify problems related to emission reporting.

The objectives of the TFEIP are therefore 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; and

- cooperate with other international organisations working on emission inventories with the aim of harmonising methodologies and reporting requirements, and avoiding duplication of work.

TFEIP meets these objectives through its one or two annual meetings (usually sponsored by a host country), by guiding the annual emissions review process and developing the Guidebook. For its detailed work it has established a number of expert panels.

1.7.2 The European Environment Agency

The European Environment Agency (EEA) (www.eea.europa.eu) is an agency of the European Union. Its task is to provide sound, independent information on the environment. EEA is a major information source for those involved in developing, adopting, implementing and evaluating environmental policy, and also the general public. The multi-annual strategy and annual work plans of the EEA are publicly available.

The regulation establishing the EEA was adopted by the European Union in 1990. It came into force in late 1993 immediately after the decision was taken to locate the EEA in Copenhagen. Operations started in October 1993, work started in earnest in 1994. The regulation also established the European environment information and observation network (Eionet) ([10]).

([10]) Regulation (EC) No 401/2009 of the European Parliament and of the Council of 23 April 2009 on the European Environment Agency and the European Environment Information and Observation Network (Codified version). OJ L126, 21.5.2009, page 13.

EEA's mandate is:

- to help the Community and member countries make informed decisions about improving the environment, integrating environmental considerations into economic policies and moving towards sustainability;

- to coordinate the European environment information and observation network (Eionet).

The main clients of the EEA are the European Union institutions — the European Commission, the European Parliament, the Council — and our member countries. In addition to this central group of European policy actors, we also serve other EU institutions such as the Economic and Social Committee and the Committee of the Regions. The business community, academia, non-governmental organisations and other parts of civil society are also important users of our information.

The geographical scope of the Agency's work is not confined to the Member States of the EU; membership is open to other countries that share the concerns of the EU and the objectives of the Agency. The Agency currently has 33 member countries:

- 28 European Union Member States — Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden and the United Kingdom;

- EU candidate country Turkey;

- Iceland, Liechtenstein, Norway and Switzerland (European Free Trade Area countries).

EEA also cooperates closely with the countries of the Western Balkans: Albania, Bosnia and Herzegovina, Croatia, Kosovo under UNSCR 1244/99, Montenegro, Serbia and the Former Yugoslav Republic of Macedonia.

The EEA works closely with the European Environment Information and Observation Network (Eionet). Eionet is a network of the EEA and its member and participating countries. It consists of the EEA itself, six European Topic Centres (ETCs) and a network of around 1 000 experts from over 350 national environment agencies and other bodies dealing with environmental information.

1.8 Point of enquiry

Enquiries concerning this chapter should be directed to the co-chairs of the Task Force on Emission Inventories and Projections. Please refer to the TFEIP website (www.tfeip-secretariat.org/) for contact details of the current co-chairs.

European Environment Agency

EMEP/EEA air pollutant emission inventory guidebook 2016
Technical guidance to prepare national emission inventories

2016 — 24 pp. — 21 x 29.7 cm

ISBN 978-92-9213-806-6
doi:10.2800/247535

TH-AL-16-020-EN-N
doi:10.2800/247535

European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

Publications Office

European Environment Agency