

EMEP/EEA air pollutant emission inventory guidebook 2019

Technical guidance to prepare national emission inventories

ISSN 1977-8449



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Luxembourg: Publications Office of the European Union, 2019

ISBN 978-92-9480-098-5

ISSN 1977-8449

doi:10.2800/293657

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Acknowledgements

The preparation and review of the 2019 *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) and the European Environment Information and Observation Network (Eionet) communities. All experts who have contributed to the preparation and review of the current and past versions of the Guidebook are sincerely thanked.

The European Environment Agency provided funding for the update of the general guidance and a number of technical chapters through work performed under Framework Contract No EEA/ACC/13/003 by a consortium comprising Trinomics, Aether, the Danish Centre for Environment and Energy Aarhus University, Ricardo and the Netherlands organisation for applied scientific research (TNO).

A European Commission Directorate-General for the Environment study, '*General Guidance on Estimating and Reporting Air Pollutant Emission Projections*', performed by Ricardo and Aether under specific contract No 070201/2018/780958/SFRA/ENV.C3 provided complementary material used to update the general guidance projections chapter.

Contributions in kind were received from TFEIP's expert panel leaders, France, Germany and the United Kingdom, which contributed to the update and finalisation of further selected chapters. A number of individuals were also instrumental in the preparation of the updated 2019 Guidebook:

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Foreword

Dear colleagues,

Welcome to the revised 2019 edition of the *EMEP/EEA air pollutant emission inventory guidebook* –‘the Guidebook’.

As has been noted in previous Guidebook versions, 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 2019 update was funded by the EEA as part of the EU’s contribution to the work of the LRTAP Convention and to support improved reporting of emission inventory information. Other chapters were updated with the support of the TFEIP’s expert panel leaders, as well as via in-kind contributions from experts from France and Germany. This 2019 version of the Guidebook has undergone review by experts from the Task Force, the EEA’s Environment Information and Observation Network (EIONET) and industry stakeholders. All comments received during the review have been considered and used in the development of the updated version as far as practicable.

More specifically, updates have been made in the following chapters:

- General guidance chapters, to align good practice principles with the 2019 refinement of the 2006 IPCC Greenhouse Gas Guidelines, and for the projections chapter to include results from a separate European Commission DG Environment funded project;

- Energy chapters, namely
 - 1.A.1 Energy industries;
 - 1.A.3.b Road transport;
 - 1.A.3.b.v Gasoline evaporation;
 - 1.A.4 Small combustion;
 - 1.B.2.c Venting and flaring.
- Industrial Processes and Product Use chapters, namely
 - 2.A.5.a Quarrying and mining of minerals other than coal (including a new spreadsheet calculation tool);
 - 2.D.3.i and 2.G Other solvent and product use.
- Agriculture chapters and a related Waste chapter, namely
 - 3.B Manure management;
 - 3.D Agricultural soils (including a new spreadsheet calculation tool);
 - 3.D.f and 3.I Use of pesticides and limestone;
 - 5.B.2 Anaerobic digestion at biogas facilities.

Ensuring consistency between the Guidebook’s definitions of sectors used to report air pollutant emissions and those used for the reporting of greenhouse gas emission inventories under the United Nations Framework Convention on Climate Change (UNFCCC) remains a priority. Against this background, the Guidebook remains structured according to the latest 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 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 *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 (especially the EU/EEA), the individuals

and organisations that undertook the latest update, and all the numerous experts from the TFEIP, EIONET and industry groups who provided comments concerning earlier draft versions.

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September 2019

1 Guidebook introduction

1.1 Introduction

The joint *EMEP/EEA air pollutant emission inventory guidebook* ⁽¹⁾, the 'Guidebook', supports 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 Convention) ⁽²⁾. It provides concise guidance on how to compile an air pollutant emissions inventory. The Guidebook is prepared by the Convention's Task Force on Emission Inventories and Projections (TFEIP), with detailed work facilitated by the Task Force's expert panels and the European Environment Agency (EEA) ⁽³⁾. The Guidebook is published by the EEA and this 2019 edition replaces all earlier versions. This updated version of the Guidebook is compatible with, and complementary to, the 2019 refinement to the 2006 Intergovernmental Panel on Climate Change (IPCC) *Guidelines for National Greenhouse Gas Inventories* ⁽⁴⁾ (hereafter the 'IPCC Guidelines').

The present version of the Guidebook has been updated but also reproduces relevant information from earlier editions. More specifically, it presents a number of important improvements and updates, including in the following areas:

- Part A general guidance chapters (notably 2. Key category analysis and methodological choice, 3. Data collection, 4. Time series consistency, 5. Uncertainties, and 6. Inventory management, improvement and quality assurance/quality control) to ensure continued alignment of emission inventory good practice principles with those defined in the IPCC Guidelines;

- Part A Chapter 8. Projections, incorporating recent recommendations for estimating emission projections based upon a recent European Commission-funded study;
- energy industries, and venting and flaring, with the update of selected emission factors;
- small combustion, namely the separation of filterable and condensable particulate matter (PM) emission factors where this is known;
- road transport sources guidance, including gasoline evaporation;
- quarrying and mining of minerals (other than coal) sources guidance including a new emissions calculation tool;
- other solvent and product use sources guidance;
- agriculture sources guidance, including from manure management, agricultural soils, and ammonia emissions from biogas production, including a new emissions calculation tool;
- use of pesticides and limestone sources guidance.

The general guidance sections continue to outline 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.

⁽¹⁾ EMEP is the Cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe — a scientific body established under the Convention on Long-range Transboundary Air Pollution. EMEP is also referred to as the European Monitoring and Evaluation Programme.

⁽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 7 for more information on these bodies.

⁽⁴⁾ Available at <https://www.ipcc-nggip.iges.or.jp/>.

NOTE:

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 technologies, and much of the emission-related information from industry is derived from facility reporting.

The present Guidebook is structured according to the Nomenclature for Reporting (NFR), which was first developed in 2001/02 by the Convention's TFEIP, further improved in 2006/07, 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 United Nations Framework Convention on Climate Change (UNFCCC). 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), now known as the ETC on Air Pollution, Transport, Noise and Industrial Pollution or ETC/ATNI remains included, where relevant.

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 ⁽⁵⁾. 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 ⁽⁶⁾.

The Guidebook is therefore 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 tropospheric ozone pollution;
- human and ecosystem exposure to hazardous substances;
- air quality degradation;
- damage and soiling of buildings and other structures.

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, as well as the public;
- defining environmental priorities and identifying the activities responsible for the problems;
- informing the setting of specific policy objectives and constraints;
- assessing the potential environmental impacts and implications of different air pollution 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;
- helping to ensure that those responsible for implementing policies comply 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 to report on cases of non-compliance to the Executive Body of the Convention.

⁽⁵⁾ Parties must submit data annually to the EMEP Centre on Emission inventories and Projections (CEIP (<http://www.ceip.at/ceip/>) for the protocols that they have ratified and which have entered into force, and inform the UNECE secretariat of the contents of their data submission.

⁽⁶⁾ Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC.

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.

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 compilers 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. Appropriate methodologies should be used, in accordance with Section V below, to promote accuracy in inventories.

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 principles, 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 2019 refinement to the 2006 IPCC Guidelines updated the concepts 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 and applying appropriate methods such as averaging, interpolation and extrapolation. A sequence of annual inventory estimates (e.g. each year from 1990 to 2018) 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:

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 (<http://www.ceip.at/>).

NOTE:

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 sectors include:

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

Each sector comprises individual source 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 tend 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 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 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:

The use of the same methods and data sources throughout should be sufficient to ensure transparency, provided there have been no recalculations. 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.

Part A. 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.

Part B. Sectoral 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.

1.4.2 Guidebook methodology principles

It is impractical to measure emissions from all the sources that, together, constitute 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 be activity data and the 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 estimation parameters other than emission factors to, for example, 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 that 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** assume a simple linear relation between activity data and emission factors. The activity data are derived from readily available statistical information (energy statistics, production statistics, traffic counts, population sizes, etc.). The default tier 1 emission factors are chosen to 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 homogeneous 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 pollutant release and transfer register data or data from emission trading schemes for industrial emissions or models such as 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 to assist Member States of the European Union to fulfil their emissions reporting requirements under the NEC Directive. In addition, the Guidebook may be used to estimate emissions of selected indirect greenhouse gases of relevance to the 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 under the European Union's National Emission Ceilings Directive

The 2016 revised version of the NEC Directive sets 2020 and 2030 emission reduction commitments for five main air pollutants responsible for acidification, eutrophication, particulate matter formation and ground-level ozone pollution, i.e. sulphur dioxide (SO₂); nitrogen oxides (NO_x); fine particulate matter (PM_{2.5}), non-methane volatile organic compounds (NMVOCs); and ammonia (NH₃). It also ensures that the emission ceilings for 2010 set in the earlier (2001) directive remain applicable for Member States until the end of 2019.

With regard to establishing and reporting emission inventory data, the NEC Directive specifies that countries shall prepare and annually update national emission totals for SO₂, NO_x, NMVOCs, PM_{2.5}, NH₃ and other pollutants for which the European Union is obliged or requested to report to the LRTAP Convention, as well as emission projections, gridded data and large point source (LPS) data. Each year, Member States must report the required information to the Commission and the EEA. Data reported by Member States under the NEC Directive are compiled and made available through the website of the EEA's Data Service (https://www.eea.europa.eu/ds_resolveuid/DAT-20-en).

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, as described in the following sections.

Reporting under the United Nations Framework Convention on Climate Change

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 sinks (and any recalculations that have occurred) of several greenhouse gases, including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and various fluorinated chemicals. Parties should also provide information on emissions of carbon monoxide (CO), NO_x and NMVOCs and are encouraged to provide information on emissions of sulphur oxides (SO_x/SO₂).

The 2006 IPCC Guidelines contain links to information on methods, used under other agreements and conventions, for the estimation of emissions of tropospheric precursors that 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 Guidebook) for the purpose of estimating emissions of SO₂, CO, NO_x, NH₃ and NMVOCs.

Reporting to the EU Greenhouse Gas Monitoring Regulation

Within the European Union and until 2020, the 2013 Regulation on a mechanism for monitoring and reporting greenhouse gas emissions, or Greenhouse Gas Monitoring Mechanism Regulation⁽⁷⁾ 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 EU level. Article 7(1)(b)

requires Member States to determine and report 'data... on their anthropogenic emissions of carbon monoxide (CO), sulphur dioxide (SO₂), nitrogen oxides (NO_x) and volatile organic compounds (VOC), consistent with data already reported pursuant to Article 7 of Directive 2001/81/EC (the earlier 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 the 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, the European Pollutant Release and Transfer Register (E-PRTR) is the main PRTR instrument for which annual reporting from Member States is required.

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 should be based on a reporting scheme that is mandatory, is annual and

⁽⁷⁾ 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.

covers multimedia releases (air, water, land) as well as transfers of waste and waste water. 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 waste water 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 to prepare for the protocol's implementation, by the preparation of guidance documents, sharing information and experiences, etc. Documents related to the tasks being undertaken by the working group are available from the website (<https://www.unece.org/env/pp/prtr.html>).

The Organisation for Economic Co-operation and Development's Pollutant Release and Transfer Register

For a number of years, the OECD has supported countries that are considering establishing a national PRTR (<https://www.oecd.org/chemicalsafety/pollutant-release-transfer-register/>). The guidance manual for governments, published in 1996 (OCDE/GD(96)32), was developed through a series of workshops that addressed the key factors countries should consider when developing a PRTR i.e. why a country should establish a PRTR, what the goals/objectives of the system are, chemical substances to be reported, how the data should be disseminated, and how a PRTR system should be implemented.

Based on the recommendation of a workshop held in Canberra, Australia, on release estimation techniques (RETs), a task force on PRTRs was established in 2000.

Its main tasks were 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-Organization programme for the sound Management of Chemicals (IOMC) PRTR coordination group and is now called the Task Force on PRTRs. Useful products include a resource centre and a PRTR portal (<https://prtr.unece.org/>) providing links with international and national PRTR activities and information sources. Information is also provided on quality control methods, the methodology for estimating emissions from small and medium-sized enterprises, emissions from product use, and links between emissions and statistical data such as national product or number of inhabitants.

The European Pollutant Release and Transfer Register

E-PRTR is the European Union's pollutant release and transfer register (<https://prtr.eea.europa.eu/>). The E-PRTR, based on Regulation (EC) No 166/2006⁽⁸⁾, succeeded the European Pollutant Emission Register (EPER) and implements the obligations of the UNECE PRTR Protocol but with a wider and more comprehensive scope. E-PRTR goes beyond the requirements of the protocol by covering more pollutants with often stricter release thresholds. It covers more than 91 substances released to air and water from industrial installations in 65 different sectors of activity; it includes transfers of waste and wastewater from industrial facilities to other locations as well as data on emissions caused by accidents on-site.

The first reporting year under the E-PRTR was 2007; these data were reported by the Member States in June 2009 and made available to the public by the European Commission and the EEA later that year. Since that year, annual updates of the data have been 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 (<https://prtr.eea.europa.eu/#/downloadguidance>).

⁽⁸⁾ 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.

1.6 Guidebook management

Maintaining the technical content of the Guidebook is the responsibility of the TFEIP ⁽⁹⁾. It is published by the EEA.

1.6.1 *Mandate of the expert panels of the Task Force on Emission Inventories and Projections*

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

- combustion and Industry;
- transport;
- agriculture and nature;
- projections (cross-cutting).

The TFEIP's expert panels have the following tasks:

- to collect and review available information on activities, emission factors and inventory methodology (emission estimates, emission factors, activity statistics, etc.);
- to consider the significance of each source in terms of its contribution to emissions and the need to identify where new source categories are needed;
- 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 and to encourage the exchange of information between experts.

1.7 Additional information

1.7.1 *Overview*

The LRTAP Convention 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 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 (Coordination d'Information Environnementale) work programme in 1985. Subsequently, the EEA task force created CORINAIR, an inventory of emissions of air pollutants in Europe, and the European Topic Centre on Air Emissions (ETC/AE) (now the European Topic Centre on Air Pollution, Transport, Noise and Industrial pollution) later took over the coordination of this work.

The TFEIP is today responsible for the technical content and the 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.

1.7.2 *CORINAIR and the EEA task force*

Council Decision 85/338/EEC ⁽¹⁰⁾ 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 — as explained above — and included a project to gather and organise information on emissions into the air relevant to acid deposition — called CORINAIR. This project started in 1986 with the objective of compiling a coordinated inventory of

⁽⁹⁾ The task force has assigned the detailed work to its expert panels which report their results to the task force.

⁽¹⁰⁾ 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.

atmospheric emissions from the 12 Member States of the Community in 1985 (CORINAIR 1985).

The CORINAIR 1985 inventory covered three substances — SO₂, NO_x, and VOCs — and recognised eight main source sectors: combustion (including power plants but excluding other industry), oil refineries, industrial combustion, processes, solvent evaporation, road transport, 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 12 Member States, Eurostat, OECD and the LRTAP Convention/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 UNFCCC, respectively.

The CORINAIR90 system was made available to:

- the 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;
- the then five European Free Trade Association (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 (now Czechia), 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 (SO₂, NO_x, NMVOC, NH₃, CO, CH₄, N₂O and CO₂);
- 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 for large point sources on an individual basis and for other, smaller or more diffuse sources, on an area basis (usually by administrative boundary at the county or 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/year;
- paper pulp plants with production capacity > 100 kt/year;
- large vehicle paint plants with production capacity > 100 000 vehicles/year;
- airports with > 100 000 landing and take-off (LTO) cycles/year;
- other plants emitting $\geq 1\,000$ t/year SO_2 , NO_x or VOC or $\geq 300\,000$ t/year 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 were finalised and published by the EEA (see under Section 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 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 ETC/AE, worked closely with the IPCC, the OECD and the 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 the ETC/AE preparing the revised SNAP97, distributed in 1998 and fully in line with the 1996 revised IPCC Guidelines.

1.7.3 EMEP and the Task Force on Emission Inventories and Projections

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 the following:

- 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.
- 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.

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 the TFEI should be merged with the Task Force on Emission Projections to form the TFEIP.

Between 2004 and 2008, the TFEIP was led by Norway and its activities were supported by the other Parties to the Convention including the European Community, through the European Commission and the EEA. In September 2008, following the approval of the EMEP Steering Body, the United Kingdom again resumed the lead-country responsibilities for the TFEIP. Since its establishment, the task force has been co-chaired by the European Union (EEA).

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

The TFEIP meets these objectives through one or two annual meetings (usually sponsored by a host country), by guiding the annual emissions review process and by developing the Guidebook. For its detailed work it has established a number of expert panels (see Section 1.6 above).

1.7.4 The European Environment Agency

The EEA (www.eea.europa.eu/) is an agency of the European Union. Its task is to provide sound, independent information on the environment. The EEA aims to support sustainable development by helping to achieve significant and measurable improvement in Europe's environment, through the provision of timely, targeted, relevant and reliable information to policymakers and the public. Its multiannual strategy and annual work plans are publicly available through its website.

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, and work started in earnest in 1994. The regulation also established the European Environment Information and Observation Network (Eionet) ⁽¹¹⁾.

The EEA's mandate is:

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

The main stakeholders of the EEA are the EU institutions, including the European Commission, the European Parliament and the Council.

The business community, academia, non-governmental organisations and other parts of civil society are also important users of the Agency's information.

The geographical scope of the Agency's work is not confined to the EU Member States; membership is open to other countries that share the concerns of the European Union and the objectives of the Agency.

The Agency currently has 33 member countries:

- 28 EU Member States — Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovenia, Slovakia, Spain, Sweden and the United Kingdom;
- Iceland, Liechtenstein, Norway, Switzerland and Turkey.

The EEA also cooperates closely with the six countries of the Western Balkans: Albania, Bosnia and Herzegovina, Kosovo ⁽¹²⁾, Montenegro, North Macedonia and Serbia.

The EEA works closely with Eionet. Eionet is a partnership network of the EEA and its member and participating countries. It consists of the EEA itself, eight European Topic Centres and a network of around 1 500 experts from over 400 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.

⁽¹¹⁾ 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.

⁽¹²⁾ Under United Nations Security Council Resolution 1244/99.

European Environment Agency

EMEP/EEA air pollutant emission inventory guidebook 2019

Technical guidance to prepare national emission inventories

2019 — 21 pp. — 21 x 29.7 cm

ISBN 978-92-9480-098-5

doi:10.2800/293657

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