

A-1: Emissions of pollutants into the atmospheric air

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1) General description

1.1) Brief definition

a) Emissions from stationary sources¹

- main pollutants: sulphur dioxide (SO₂), nitrogen oxides (NO_x) (given in terms of dioxide nitrogen, NO₂), non-methane volatile organic compounds (NMVOCs), ammonia (NH₃), carbon monoxide (CO), hydrocarbons (CH) and particulate matter (PM₁₀, PM_{2.5} and total suspended particulates (TSP));
- persistent organic pollutants (POPs), including polychlorinated biphenyls (PCBs), polychlorinated dibenzodioxins/dibenzofurans (PCDD/F) and polycyclic aromatic hydrocarbons (PAHs);
- heavy metals, mainly lead (Pb), cadmium (Cd), mercury (Hg), nickel (Ni), and arsenic (As);
- specific polluting substances.

The pollutants should be provided in total volumes and can be broken down by economic activities as defined by the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 4); comparison of the present values with targets (if any) and with emission projections (if available).

b) Emissions from mobile sources²

- exhaust emissions of CO, NO_x (given in terms of nitrogen dioxide, NO₂), CH, NMVOCs, PM₁₀, PM_{2.5}, TSP, SO₂, formaldehyde, benzo(a)pyrene and lead compounds;
- non-exhaust emissions of PM₁₀, PM_{2.5} and TSP originated in tyre, break and roads surface wear.

The emissions should be provided in total volumes and can be broken down by mode of transport (road, railway, air, inland waterways and non-road mobile machinery); comparison of the current values with targets (if any) and with emission projections (if available).

c) Total emissions

The sum of emissions of particular pollutant (group of pollutants) from stationary and mobile sources.

¹ Stationary sources include both point sources and fugitive sources.

² Mobile sources include vehicles for road, rail, inland water and air transport as well as non-road mobile machinery.

1.2) Units of measurement

- Thousands of tons per year, tons per year or kilograms per year, as appropriate for a particular pollutant.
- For cross-country comparisons, the indicator may also be presented per km² of the country's territory, per capita or per unit of gross domestic product (GDP). GDP is to be presented at constant prices in international dollars³ at purchasing power parity (PPP). In comparisons with targets, percentages are used. This indicator can also be presented in terms of emissions (kg) per unit of production (ton, m², kWh, etc.).

1.3) Context

Relation to other indicators from the Guidelines - This indicator relates to indicator „A-2: Ambient air quality in urban areas“.

2) Relevance for environmental policy

2.1) Purpose

The indicator provides a measure of existing and expected pressure on the environment in terms of emissions of harmful substances into the atmospheric air and “distance to target” (if any).

2.2) Issue

The pollutants listed in Brief definition are known for their adverse effects on human health and ecosystems. Some of these pollutants are eroding technical infrastructures as well. NO_x and NMVOCs are precursors of the formation of ground-level ozone, which also has adverse effects on human health and ecosystems. NO_x, SO₂, NMVOCs and NH₃ are precursors of the formation of “secondary particles” which represent considerable part of the total pollution by particulate matter.

The indicator is important not only for assessing pressure from atmospheric air pollution in the country as a whole but also for identifying pressure from stationary and mobile sources of particular economic activities like energy, transport, industrial processes, agriculture and waste management, and from households.

³ International dollar is monetary unit which is being used by the World Bank for the calculation of GDP at PPP.

On the basis of this indicator, public authorities can adjust the national environmental policy by, for instance, revising emission standards and emission limit values, strengthening permitting of potentially polluting activities and improving the application of economic instruments. The public in turn should be informed in an understandable way of the status of the problem and the ways of tackling it. Information on pollutant emissions is also necessary for the assessment of transboundary air pollution and for international cooperation to address this problem.

2.3) International agreements and targets

a) Global level

Under the Stockholm Convention on Persistent Organic Pollutants, both limit values and reporting requirements are set at the global level.

b) Regional level

The ECE Convention on Long-range Transboundary Air Pollution (CLRTAP) requires implementation of measures to prevent, control and reduce emissions of air pollutants and to exchange information on them. The Convention and its eight protocols⁴ together set targets for the reduction of specific emissions, prescribe stringent emission limit values for emission sources, propose concrete pollution reduction measures and establish requirements regarding the submission of data on emissions of the above-mentioned pollutants. The “older” protocols on sulphur, NO_x and NMVOC have been followed-up by the Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone which represents new “multi pollutant - multi effect” approach and sets emission reduction targets (emission ceilings) for SO₂, NO_x, NH₃ and NMVOCs which were to be reached by 2010.

In 2012, substantial revision of the Gothenburg Protocol was adopted including new national emission ceilings (expressed in percentage reduction from 2005 levels) to be reached by 2020 and addition of the fifth controlled pollutant – PM_{2.5}. Protocol on Heavy Metals covers Cd, Pb and Hg and the Protocol on Persistent Organic Pollutants regulates group of pollutants which is being extended through pending amendments.

The Protocol on Pollution Release and Transfer Registers (PRTR) to the ECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters provides for the collection and presentation of data on emissions of pollutants into the air.

c) Subregional level

The Environmental Strategy of countries of South-Eastern and Eastern Europe, Caucasus and Central Asia, approved in 2003 by the Kiev Ministerial Conference “Environment for Europe”, foresees the implementation of legislative, normative, economic, financial,

⁴ See <http://www.unece.org/env/lrtap/welcome.html>.

technical and other measures which would lead to the reduction of emissions of pollutants into the air. In the European Union (EU), Directive 2001/81/EC on national emissions ceilings for certain atmospheric pollutants requires the introduction of national emission ceilings for emissions of SO₂, NO₂, NMVOC and NH₃ in each Member State which were to be complied with by 2010. In some cases, values of national emissions ceilings are more stringent (lower) than those under the Gothenburg Protocol⁵. Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) provides for emission limit values and other technical measures to reduce emissions from particular installations (e.g. large combustion plants, waste incinerators, installations using organic solvents). Emissions of pollutants from road transport are regulated by directives 98/70/EC and 2005/55/EC and those from non-road mobile machinery by directives 2000/303/EC and 2002/88/EC. Emissions of NMVOC from paints and varnishes are controlled by directive 2004/42/EC and those originated in storage and distribution of petrol by directives 94/63/EC and 2009/126/EC.

3) Methodology and guidelines

3.1) Data collection and calculations

Combination of three basic methods is generally applied for the development of emission inventory:

- Measurement (large stationary sources): continuous or periodic measurement of emissions is often required by the legislation in the case of specific categories of sources (e.g. large combustion plants, waste incinerators, large industrial installations);
- Calculation (medium sized stationary sources, mobile sources): calculations are being carried out on the basis of general formula: *Activity x emission factor*⁶, where activities include data on production or transport volumes and fuel or raw materials consumption.
- Expert assessment (small sized stationary sources, fugitive sources): expert assessment can be based for instance on the results of census (household heating).

3.2) Internationally agreed methodologies and standards

CLRTAP and its eight protocols cover the methodology of collection of data on emissions of pollutants into the air. The best guidance for the assessment of emissions through calculations can be found in the 2009 EMEP/EEA Air Pollutant Emission Inventory Guidebook, which covers all relevant sectors of human activity and offers methodologies at several different levels of complexity.

⁵ At present, this Directive is undergoing revision in relation to the revision of the Gothenburg Protocol.

⁶ In some cases (mostly in the transport sector), emission factors are functions of other parameters (e.g. velocity of vehicle).

As for the data collection and reporting format, the ECE nomenclature for reporting (NFR) represents the main source classification system for air emission reporting. In addition, the selected nomenclature for sources of air pollution (SNAP97) has been developed by the EEA European Topic Centre on Air Emissions (ETC/AE). The Common Reporting Format (CRF) of the Intergovernmental Panel on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC) is applicable for certain air pollutants which are considered as “indirect greenhouse gases” (CO, NO_x, SO₂, NMVOC) and data on their emissions are reported under UNFCCC. Guidelines for Reporting Emission Data under the CLRTAP have been updated in 2009.

At the EU level, technical requirements on emission measurements for selected sources (e.g. large combustion plants, waste incinerators, installation using organic solvents) are laid down in legislation (Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)). Annual reporting on national emissions of SO₂, NO_x, NMVOC and NH₃ is requested by Directive 2001/81/EC on national emission ceilings and emissions from selected important industrial installations are being reported according to Regulation 166/2006/EC on the European Pollution Release and Transfer Register (PRTR).

4) Data sources and reporting

In the countries of South-Eastern and Eastern Europe, Caucasus and Central Asia, national statistical and/or environmental agencies collect data on emissions into the air from stationary sources using standardized reporting form. Data on emissions from mobile sources are frequently calculated on the basis of fuel consumption by vehicle fleets. Aggregated data are published in annual national environmental and statistical reports and on websites. Parties to CLRTAP report emission data for the main air pollutants, metals and POPs and (if available) emission projections. Reported data may be accompanied by Informative Inventory Reports. The emission database is managed by EMEP. Countries report emission data for SO₂ and NO_x to UNSD in response to the UNSD/UNEP questionnaire on environmental statistics. Emission data for indirect greenhouse gases are reported under the UNFCCC.

5) References at the international level

- Guidelines for Estimating and Reporting Emission Data under the Convention on Long-range Transboundary Air Pollution. ECE/EB.AIR/97. Revision 2009: http://www.ceip.at/fileadmin/inhalte/emep/reporting_2009/Rep_Guidelines_ECE_EB_AIR_97_e.pdf;

- EMEP/EEA Air Pollutant Emission Inventory Guidebook - 2009 (EEA Technical Report 9/2009). See <http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009>;
- European Union Emission Inventory 1990–2010 under the ECE Convention on Long-range Transboundary Air Pollution (EEA Technical Report 8/2012): <http://www.eea.europa.eu/publications/eu-emission-inventory-report-1990-2010>;
- Evaluation of Progress under the EU National Emission Ceilings Directive (EEA Technical Report 14/2012): <http://www.eea.europa.eu/publications/evaluation-progress-nec-2012>;
- Air Emissions Inventory, Air Pollution Monitoring and Modelling in Kazakhstan. In: Environmental Monitoring and Assessment: Eastern Europe, the Caucasus and Central Asia. UNECE, 2003. (CD-ROM);
- Environmental Partnership in the UNECE Region: Environmental Strategy for Countries of Eastern Europe, Caucasus and Central Asia, 2003. (ECE/CEP/105/Rev.1);
- Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on National Emission Ceilings for Certain Atmospheric Pollutants;
- Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control);
- Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC;
- Directive 2004/42/CE of the European Parliament and of the Council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC;
- Directive 2005/55/EC of the European Parliament and of the Council of 28 September 2005 on the approximation of the laws of the Member States relating to the measures to be taken against the emission of gaseous and particulate pollutants from compression-ignition engines for use in vehicles, and the emission of gaseous pollutants from positive-ignition engines fuelled with natural gas or liquefied petroleum gas for use in vehicles;
- Directive 2002/88/EC of the European Parliament and of the Council of 9 December 2002 amending Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery;
- Directive 2000/25/EC of the European Parliament and of the Council of 22 May 2000 on action to be taken against the emission of gaseous and particulate pollutants by engines intended to power agricultural or forestry tractors and amending Council Directive 74/150/EEC;
- European Parliament and Council Directive 94/63/EC of 20 December 1994 on the control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations;
- Directive 2009/126/EC of the European Parliament and of the Council of 21 October 2009 on Stage II petrol vapour recovery during refuelling of motor vehicles at service stations;
- 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 and amending Council Directives 91/689/EEC and 96/61/EC;
- ECE Convention on Long-range Transboundary Air Pollution (CLRTAP): <http://www.unece.org/env/lrtap/welcome.html>;

- EMEP (Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollution in Europe): <http://www.emep.int>; <http://www.ceip.at/>;
- IPCC (Intergovernmental Panel on Climate Change): <http://www.ipcc-nggip.iges.or.jp/public/gl/invs4.htm>;
- UNSD (United Nations Statistic Division): <http://unstats.un.org/unsd/environment/>;
- EEA (European Environment Agency): <http://themes.eea.europa.eu/IMS/CSI>;
- Eurostat:
<http://epp.eurostat.ec.europa.eu/portal/page/portal/environment/introduction>;
- European Commission: http://ec.europa.eu/environment/air/index_en.htm.