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**APPLICATION OF ENVIRONMENTAL INDICATORS IN EASTERN EUROPE,
THE CAUCASUS AND CENTRAL ASIA**

Note by the secretariat

SUMMARY

This note presents the core set of environmental indicators for Eastern Europe, the Caucasus and Central Asia (EECCA) and progress made in the preparation of a manual on the application of environmental indicators to help: (a) improve environmental reporting in EECCA countries; (b) make their national environmental assessments comparable both among themselves and with other UNECE countries; and (c) facilitate data gathering for future regional environmental reports. The Working Group is expected to agree on indicators for the inclusion on the manual, the format for indicator descriptions and on further work to complete the manual.

1. At present, the EECCA countries use a wide variety of environmental indicators when publishing state-of-the-environment reports and environmental statistics compendiums (see, for instance, the secretariat note on the current situation with the use of environmental indicators in EECCA (CEP/AC.10/2003/6/Rev.1). The involvement of the EECCA countries in the preparation of the Kiev Assessment report for the Fifth Ministerial Conference “Environment for Europe” (2003) triggered their interest in the development of an agreed set of indicators that would both improve national environmental reporting and facilitate comparisons with other countries.

2. At a workshop organized by the Working Group in cooperation with the European Environment Agency (EEA) in July 2003 near St. Petersburg (Russian Federation), national EECCA experts selected 118 indicators to constitute a core set of environmental indicators for EECCA. These were selected in fact from the list of 354 indicators that EEA had compiled as a

starting point in its work on its own core set of indicators. The EECCA indicators were grouped according to the environmental priorities and the sectors of the economy (table).

Table. EECCA indicators based on environmental priorities

| Priority | Number of indicators | Sector | Number of indicators |
|----------------|----------------------|-------------|----------------------|
| Air pollution | 25 | | |
| Climate change | 11 | Agriculture | 3 |
| Water | 35 | Energy | 7 |
| Terrestrial | 6 | Transport | 7 |
| Biodiversity | 12 | | |
| Waste | 12 | | |

3. In selecting indicators and their evaluation, EECCA experts used the following criteria:

- (a) Relevance to national environmental priorities;
- (b) Relation to international environmental policy;
- (c) Role as a means of communication for public awareness;
- (d) Measurability;
- (e) Availability of time series;
- (f) Predictive ability: capacity to track the effectiveness of pursued environmental

policy.

4. To test the usefulness of the core set of indicators for EECCA countries and its feasibility, the UNECE secretariat prepared a trial compendium, gathering data for 30 indicators from the core set, which demonstrated interrelations between, on the one hand, economic and sectoral policies and, on the other, environmental policy. Data were collected in six interested countries: Azerbaijan, Belarus, Georgia, Kyrgyzstan, the Russian Federation and Tajikistan. The compendium proved that the environmental and statistical reporting systems in EECCA countries allowed for the practical use of a number of indicators from the core set. The list of 118 indicators, including the results of their assessment by EECCA country, as well as the trial compendium are available on the web site of the Working Group (http://www.unece.org/env/europe/monitoring/landR_en.html).

5. Members of the Working Group from EECCA countries expressed their appreciation for the core set of EECCA indicators and the trial compendium at a joint UNECE/EEA workshop in November 2003 in Geneva (see http://www.unece.org/env/europe/monitoring/Coord_en.html). EECCA officials also requested guidelines or a manual for the application of environmental indicators with a detailed description of each indicator and recommendations on how to adapt the monitoring system for primary collection and with references to international standards, policy targets and reference documents. The manual would be helpful for environmental officials and statisticians. It might also be of interest to other parties in the EECCA countries such as business and industry, academics and non-governmental organizations as well as to other UNECE countries.

6. To this end, a feasibility study was undertaken. Ten indicators from the core set were described following the methodology of the United Nations Commission on Sustainable Development (CSD). Links with CSD indicators of sustainable development

(<http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf>) and indicators of the Kiev Assessment report (<http://www.unece.org/env/europe/monitoring/EnvMonRep/index.html>) were demonstrated case by case. The feasibility study led to a decision to continue and the secretariat invited five experts from Belarus, Georgia, the Republic of Moldova, the Russian Federation and Turkmenistan in early 2004 to help it in preparing descriptions of all indicators from the core set.

7. To discuss draft indicator descriptions, a workshop on the application of environmental indicators was organized, in cooperation with the Regional Environmental Centre (REC) Moldova, on 5-6 July 2004 in Chisinau. Most participants were experts on environmental indicators from the Ministries of the Environment (or attended on their behalf) and representatives of statistical services working in environmental statistics in all EECCA countries. Representatives of UNECE, the United Nations Statistics Division (UNSD), EEA, the Organisation for Economic Co-operation and Development (OECD) and the Interstate Statistical Committee of the Commonwealth of Independent States also took part. Workshop documentation is available on the Web at http://www.unece.org/env/europe/monitoring/landRPr2_en.html.

8. The workshop discussed the concept and approach to the development of the proposed guidelines or manual and reviewed the draft descriptions of each indicator intended for inclusion. It voiced the need for shortening the list of indicators to be covered by the manual and for updating it in the light of indicator developments at the international level. Particular reference was made to:

- (a) The indicators from the UNSD/United Nations Environment Programme (UNEP) Questionnaire on Environment Statistics (<http://unstats.un.org/unsd/environment/questionnaire2004.htm>);
- (b) The EEA core set of indicators of 2004 (<http://themes.eea.eu.int/IMS/CSI>);
- (c) The indicators for the second environmental performance reviews (EPR) under the UNECE review programme (CEP/2004/6);
- (d) World Health Organization (WHO)/Europe proposals for a core set of European environmental health indicators (http://www.euro.who.int/ehindicators/indicators/20030528_1).

9. Discussions on draft descriptions of indicators from the EECCA core set identified a number of overlaps between indicators and opportunities for combining several of these. Specific proposals were made to streamline indicator descriptions and make them more policy-oriented and closely linked with multilateral environmental agreements and international targets, standards and guidelines. The Workshop demonstrated that substantive further work and discussions were needed before a manual on the application of environmental indicators in EECCA could be submitted to the Committee on Environmental Policy for adoption.

10. Following the Workshop, the secretariat prepared a list of key environmental indicators for the manual. It is contained in annex I below and lists 38 indicators taken from the core set of EECCA indicators. The indicators that were retained were those that had originally been classified by many EECCA countries as top priority from the point of view of both national and international requirements, as understandable to the public and supported, to the extent possible, by international methodological guidance. Presence in other international indicator lists was an important additional selection criterion. Several indicators from the EECCA core set (e.g. air pollution indicators) were combined in view of their common features such as international

requirements, guidelines, calculation methods and reference materials. Depending on their role in the assessment of the issue, key indicators are classified according to the DPSIR framework: Driving forces (D) – Pressures (P) – State (S) – Impact (I) – Responses (R).

11. Annex II presents three examples of revised indicator descriptions for the manual. It is proposed that the descriptions should highlight the importance of the environmental issue for which the indicator has been designed, make reference to international targets that the indicator should concretize, specify requirements for measurements and data collection to support the indicator, and provide references to internationally agreed methodologies, monitoring standards, calculation methods and the literature. Considerable work will be required to make descriptions of each indicator sufficiently detailed, concrete and succinct, at the same time. In view of current weaknesses with data collection and measurement methods in EECCA countries, the manual should assist environmental authorities and statistical offices in these countries to improve reporting on indicators such as:

- (a) Air pollution and ozone depletion: pollutant emissions by various sector sources;
- (b) Climate change: greenhouse gas emissions, particularly other than CO₂;
- (c) Water: pollutants in freshwaters;
- (d) Biodiversity: species diversity;
- (e) Energy: energy consumption by fuel;
- (f) Waste: waste generation, treatment and disposal.

12. Once the Working Group has agreed on the key indicators and on the indicator description format, the manual on the application of key environmental indicators in EECCA can be completed. This would include hiring consultants to prepare revised indicator descriptions and organizing a further workshop or a consultation end 2005-early 2006 to finalize the manual for consideration by the Working Group at its session in 2006.

Annex I

KEY ENVIRONMENTAL INDICATORS FOR EASTERN EUROPE, THE CAUCASUS AND CENTRAL ASIA

| INDICATORS | DPSIR | EPR indicators | UNSD/UNEP environment statistics questionnaire | WHO/Europe environmental health indicators | CSD indicators | "Kiev" indicators | EEA core set of indicators |
|---|-------|----------------|--|--|----------------|-------------------|----------------------------|
| Air pollution and ozone depletion | | | | | | | |
| 1. Emissions of pollutants into the atmospheric air: total, by sector source, per capita and per unit of GDP (SO ₂ , NO _x , NH ₃ , PM ₁₀ , PM _{2.5} , TSP, non-methane volatile organic compounds, persistent organic pollutants (PCBs, dioxins/furans and PAH) and heavy metals (cadmium, lead and mercury) | P | X | X | X | | X | X ^{a/} |
| 2. Air quality in urban areas: days or percentage (number or percentage of days with an air pollution level (at least SO ₂ , NO ₂ , CO, PM ₁₀ and O ₃) exceeding maximum allowable concentrations (MACs) or the fraction of urban population in a country exposed to air pollution above the MACs) | I | X | X ^{b/} | X ^{c/} | X | | X ^{d/} |
| 3. Consumption of ozone-depleting substances | P | X | | | X | X | X |
| Climate change ^{e/} | | | | | | | |
| 4. Greenhouse gas emissions: total, by sector source, per capita and per unit of GDP (CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆) | P | X | X | | X | X | X |
| 5. Greenhouse gas emissions vs targets (if established) | P/R | X | | | X | X | |
| 6. Projections of greenhouse gas emissions | P/R | | | | | X | X |
| Water ^{f/} | | | | | | | |
| 7. Renewable freshwater resources (surface and groundwater) | P | X | X | | | | X |

^{a/} Subdivided into three indicators: emissions of acidifying substances, emissions of ozone precursors, and emissions of primary particulates and secondary particulate precursors.

^{b/} Annual mean concentrations of SO₂, NO₂ and PM₁₀ in ambient air in cities and at background sites.

^{c/} Population-weighted urban annual average concentration of: NO₂, PM₁₀, PM_{2.5}, SO₂. Distribution of daily O₃.

^{d/} Supplemented also by the indicator of Exceedance of air quality limit values in rural areas.

^{e/} EEA list includes also the following two indicators: Atmospheric greenhouse gas concentrations and Global and European temperature.

^{f/} EEA list includes also indicators of: Bathing water quality and Chlorophyll in transitional coastal and marine waters. Both the EEA and WHO/Europe lists include the indicator of Percentage of national population connected to waste-water treatment.

| INDICATORS | DPSIR | EPR indicators | UNSD/UNEP environment statistics questionnaire | WHO/Europe environmental health indicators | CSD indicators | "Kiev" indicators | EEA core set of indicators |
|---|-------|-----------------|--|--|-----------------|-------------------|----------------------------|
| 8. Freshwater abstraction: total, by economic activity, per capita and as percentage of renewable freshwater resources | P | X | X ^{g/} | | X ^{h/} | X | X |
| 9. Household water use per capita | P | X | | | | | X |
| 10. Water losses | R | | X | | | | |
| 11. Reuse of freshwater in manufacturing industries | R | | X | | | | |
| 12. Drinking-water quality: proportion of samples failing the standard | I | | | X | | | |
| 13. Oxygen-consuming substances in rivers (biological oxygen demand and ammonium) | S | X | X | | X | X | X |
| 14. Nutrients (nitrates and phosphates) in freshwater (rivers, lakes and groundwater) | S | X | X | | | X | X |
| 15. Nutrients in coastal waters | S | | X | | | | X |
| 16. Non-treated urban waste water: as percentage of total urban waste-water discharge | R | X | X | | | | |
| Terrestrial ^{i/} | | | | | | | |
| 17. Land uptake (by transport infrastructure, urban development and by landfills, waste dumps, tailing pits and refuse heaps) | I | X ^{i/} | X ^{i/} | | X ^{i/} | | X ^{k/} |
| 18. Area affected by soil erosion: total and share of affected agricultural land | S | X | X | | X | X | |
| Biodiversity ^{l/} | | | | | | | |
| 19. Threatened and protected species: total number, number per species group and number of globally threatened species under protection | S | X | | | | | X |

^{g/} Also by surface and ground water, separately.

^{h/} As percentage of renewable freshwater resources only.

^{i/} EEA list includes also indicator of Progress in management of contaminated sites.

^{j/} Land use.

^{k/} By transport infrastructure and urban development only.

^{l/} EEA list includes also three indicators under Fisheries section: Status of marine fish stocks, Aquaculture production and Fishing fleet capacity.

| INDICATORS | DPSIR | EPR indicators | UNSD/UNEP environment statistics questionnaire | WHO/Europe environmental health indicators | CSD indicators | "Kiev" indicators | EEA core set of indicators |
|--|-------|----------------|--|--|-----------------|-------------------|----------------------------|
| 20. Designated areas: total area, as percentage of national territory and by World Conservation Union (IUCN) category | R | X | | | X | X | X |
| 21. Forest and other wooded land: total, as percentage of land area and by category of "naturalness" | S | X | X ^{m/} | | X | | |
| 22. Trends in abundance and distribution of selected species (e.g. forest, hunting and other species of economic interest) | S/R | | | | X | | X ^{n/} |
| Agriculture ^{o/} | | | | | | | |
| 23. Fertilizer consumption | P | X | | | X | X | |
| 24. Pesticide consumption | P | X | | | X | X | |
| Energy ^{p/} | | | | | | | |
| 25. Final energy consumption: total and by sector | D | X | | | X | | X |
| 26. Total energy intensity (gross inland energy consumption per unit of GDP) | R | X | | | X | X | X |
| 27. Total energy consumption: total and by fuel | D | X | | | | X | X |
| 28. Renewable energy consumption: total and by renewable source | R | | | | X | X | X |
| Transport ^{q/} | | | | | | | |
| 29. Passenger transport demand by mode | D | X | | X | X | X | X |
| 30. Freight transport demand by mode | D | X | | X | | X | X |
| 31. Size and composition of vehicle fleet | D | X | | | | X | |
| 32. Average age of vehicle fleet | D | | | X | | | |
| 33. Road traffic accident, mortality and injury rate | I | X | | X | | | |
| Waste | | | | | | | |
| 34. Generation of waste: total and by category (hazardous, industrial and municipal solid waste) | P | X | X ^{r/} | | X ^{s/} | X | X ^{t/} |

^{m/} Total area only.

^{n/} Indicator of Species diversity focuses on selected common birds related to farmlands, woodlands and wetlands.

^{o/} EEA lists the following indicators: Gross nutrient balance and Area under organic farming.

^{p/} EEA also lists an indicator of Renewable electricity.

^{q/} EEA also lists an indicator of Use of cleaner and alternative fuels.

^{r/} Covers also waste from agriculture and forestry, and from other activities.

^{s/} Excluding total waste generation.

| INDICATORS | DPSIR | EPR indicators | UNSD/UNEP environment statistics questionnaire | WHO/Europe environmental health indicators | CSD indicators | "Kiev" indicators | EEA core set of indicators |
|---|-------|----------------|--|--|----------------|-------------------|----------------------------|
| 35. Waste intensity (total waste generated per unit of GDP) | D/R | X | | | | | |
| 36. Transboundary movements of hazardous waste (export and import) | D | X | | X | | | |
| 37. Waste recycling: as percentage of total or of the specific category of waste | R | X | | X ^{1/} | X | X | X ^{2/} |
| 38. Final waste disposal (by incineration, landfilling or other method): total and by category of waste | P/R | | | X ^{3/} | | X | |

Note: DPSIR: Driving forces (D) - Pressure (P) - State (S) - Impact (I) – Response (R)

^{1/} Municipal and packaging waste only.

^{2/} Municipal and hazardous waste by volume.

^{3/} Recycling of packaging waste only.

Annex II

ELEMENTS FOR THE MANUAL ON THE APPLICATION OF KEY ENVIRONMENTAL INDICATORS IN EECCA

EMISSIONS OF POLLUTANTS INTO THE ATMOSPHERIC AIR

1. *General description*

(a) **Brief definition:** Emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x), ammonia (NH₃), particulate matter (PM₁₀, PM_{2.5} and total suspended particles (TSP)), non-methane volatile organic compounds (NMVOCs), persistent organic pollutants (PCBs, dioxins/furans and PAH) and heavy metals (cadmium, lead and mercury): total and by sector source;

(b) **Unit of measurement:** Thousands of tons (Gg) of each pollutant a year. For cross-country comparisons, the indicator may be presented also in Gg per km² of the country's territory or per capita.

2. *Environmental policy relevance*

(a) **Purpose:** The indicator provides a measure of the pressure on the environment in terms of emissions of harmful substances into the atmospheric air;

(b) **Issue:** The above-mentioned pollutants are known for their adverse effects on human health and ecosystems. Some of these pollutants are eroding technical infrastructures as well. Emissions of NO_x and NMVOC are responsible for the formation of ground-level ozone, which has adverse effects on human health and plants. The indicator is important for the identification and the assessment of the atmospheric air pollution originating in the country and the input of individual sector sources like energy industries, transport, industrial processes, agriculture and waste management. On the basis of this indicator, public authorities should adjust the national environmental policy by, for instance, revising emission standards and emission limit values, strengthening licensing and permitting of potentially polluting activities and improving the application of economic instruments, while the public should be informed in an understandable form of the status of the problem and the ways of settling it. Information on pollutant emissions is also necessary for the assessment of transboundary air pollution and for the international cooperation on this problem;

(c) **International agreements and targets:** The UNECE Convention on Long-range Transboundary Air Pollution commits its Parties to preventing, controlling, reducing and exchanging information on emissions of air pollutants. The Convention and its eight protocols together set targets for the reduction of specific emissions, prescribe stringent limits for emission sources, propose concrete pollution reduction measures and establish requirements regarding the submission of data on emissions of the above-mentioned pollutants. The Executive Body for the Convention has invited Parties to report also on 6 additional heavy metals and 16 further POPs. The Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone sets emission reduction targets for SO_x, NO_x, NH₃ and NMVOCs to be reached by 2010. The Stockholm Convention on Persistent Organic Pollutants sets relevant limits and reporting requirements at the global level. 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 and NO_x in each member State, as well as setting interim environmental objectives for reducing the exposure of ecosystems and human populations to acid pollutants and ozone.

3. *Methodology and guidelines*

(a) **Data collection and calculations:** Two basic methods of emission inventory are generally applied: the first, detailed, one is based on direct measurements of emissions, and the second, simplified, one is based on the use of industrial statistics (production volumes and fuel and raw materials consumption in particular) and the relevant emission factors. All emissions sources should be grouped into categories of sources covering both anthropogenic and natural sources. National classifications of emission sources have to be harmonized with the international ones. Monitoring of emissions from road transport, energy industries and agriculture should be improved. Among the individual pollutants, the reporting of emissions of heavy metals and POPs requires particular attention in EECCA countries. Modelling should be applied where data coverage is incomplete;

(b) **Internationally agreed methodologies and standards:** There are the EMEP (Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe)/CORINAIR (CORE INventory of AIR emissions) Emission Inventory Guidebook and the UNECE Guidelines for Estimating and Reporting Emissions. These are linked with the revised 1996 Guidelines of the Intergovernmental Panel for Climate Change (IPCC), which are the basis for reporting to the United Nations Framework Convention for Climate Change (UNFCCC). There is a correlation between the UNECE *nomenclature for reporting* (NFR) source sector classification system for emission data reporting, the *selected nomenclature for sources of air pollution* (SNAP97) developed by the EEA European Topic Centre on Air Emissions (ETC/AE) and reporting source categories of the IPCC/UNFCCC *common reporting format* (CRF).

4. **Data sources and reporting:** Parties to the Convention on Long-range Transboundary Air Pollution have reported emissions for 1980-2002 and projections for 2010, 2015 and 2020. PM emissions have been reported since 2000. For heavy metals and POPs, reporting obligations are from 1990 onwards. The emission database is managed by EMEP. EECCA countries reported emission data to EEA for the Kiev Assessment report and to UNSD in response to the UNSD/UNEP questionnaire on environmental statistics.

5. *References at the international level*

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- <http://reports.eea.eu.int/EMEPCORINAIR4/en>

AIR QUALITY IN URBAN AREAS

1. General description

(a) **Brief definition:** The number or percentage of days during a certain period of time with an air pollution level exceeding the established limit values maximum allowable concentrations (MACs) in urban areas with regular observations of air quality. It may also show the fraction of urban population in a country exposed to air pollution above the established limits;

(b) **Unit of measurement:** Days or percentage.

2. Environmental policy relevance

(a) **Purpose:** The indicator provides a measure of the state of the environment in terms of air quality and the impact of air pollution on population and ecosystems;

(b) **Issue:** Air pollutants can have various adverse impacts on human health, vegetation and materials. Exposure to particulate matter, measured as concentrations of PM₁₀ or PM_{2.5} in ambient air, represents one of the largest human health risks from air pollution. Short-term inhalation of high concentrations may cause increased symptoms for asthmatics, respiratory symptoms, reduced lung capacity and even increased death rates. There is considerable evidence of human environmental and occupational exposures to carbon monoxide (CO). SO₂, NO_x and ground-level ozone in ambient air can affect human health, and damage crops, vegetation and materials. Ozone is not emitted directly,

but is formed in the lower atmosphere by reaction of VOCs and NO_x in the presence of sunlight;

(c) **International agreements and targets:** The Convention on Long-range Transboundary Air Pollution and its protocols commit the Parties to reducing and preventing air pollution. This should be done by various measures including regulatory ones such as setting air pollution quality standards for sulphur, NO₂, NO_x, NH₃, VOC, ozone, particulate matter, lead, mercury, cadmium and POPs. The European Union has set some specific targets for air quality. Council Directive 1999/30/EC requires the following targets to be met by 2005 (limit values for NO₂ by 2010):

- For SO₂:
 - Daily average of 125 µg SO₂/m³ should not be exceeded more than 3 times a calendar year;
 - Hourly limit value of 350 µg SO₂/m³ should not be exceeded more than 24 times a calendar year;
- For particulate matter:
 - Annual average 40 µg/m³;
 - 24-h average for PM₁₀ of 50 µg/m³ should not be exceeded more than 35 times a calendar year;
- For NO₂:
 - Annual average 40 µg/m³;
 - Hourly limit value 200 µg NO₂/m³ should not be exceeded more than 18 times a calendar year.

Directive 2002/3/EC requires the following target for ambient ozone to be met by 2010:

- Daily maximum 8-hourly average 120 µg O₃/m³ should not be exceeded more than 25 times a calendar year averaged over three years.

3. *Methodology and guidelines*

(a) **Data collection and calculations:** An air quality-monitoring network may consist of fixed and/or mobile monitoring stations. The selection strategy for site locations should focus on areas with the highest concentration of emission sources (mobile and stationary). Suitable air monitors must fulfil several requirements, such as detection limits, interferences, time resolution, easy operation, and of course, cost. There are many good references in the literature on the most appropriate and up-to-date air monitoring and analysis methods. Proven models are also available for estimating ambient concentration of air pollutants. National calibration laboratories have to be established and quality assurance/quality control (QA/QC) procedures introduced. The number of days of exceedance per city should be obtained by averaging the results of all air quality monitoring stations in the city. Urban population is a total number of people living in cities with at least 1 monitoring station. The indicator should be calculated for exceedance of MACs for a limited number of priority pollutants such as SO₂, NO₂, PM₁₀ and O₃;

(b) **Internationally agreed methodology and standards:** WHO Air Quality Guidelines for Europe covering 35 pollutants may be used in setting legally binding limits (standards) for air pollutants. ISO standards 13.040, Air quality may be applied for monitoring purposes.

4. **Data sources and reporting:** Data on ambient air pollution concentrations are often routinely collected in EECCA by sanitary and epidemiological monitoring networks and meteorological services. EECCA countries reported emission data to EEA for the Kiev Assessment report and to UNSD in response to the UNSD/UNEP questionnaire on environmental statistics. The WHO Healthy Cities Network and the Air Quality and Health programme of the WHO Regional Office for Europe collect air quality data from participating national agencies. Eurostat, EEA and OECD collect air

quality data from their member States.

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- <http://www.oecd.org>.

OZONE-DEPLETING SUBSTANCES

1. *General description*

- (a) **Brief definition:** The indicator specifies total amount of ozone-depleting substances (ODS) that were produced, sold or consumed in a country;
- (b) **Unit of measurement:** Tons (Gg) of ODS weighted by their ozone-depletion potential (ODP).

2. *Environmental policy relevance*

- (a) **Purpose:** The indicator provides a measure of the pressure on the environment of substances that deplete the ozone layer;
- (b) **Issue:** The ozone layer in the stratosphere is an essential component of the Earth's atmosphere. It protects humans, animals and plants from damaging shortwave ultraviolet (UV) radiation. Ozone is destroyed (dissociated) by reactions with certain ODS in the presence of somewhat longer wavelength UV radiation. Compounds that cause significant ozone depletion include chlorofluorocarbons (CFCs), carbon tetrachloride, methyl chloroform, halons, hydrochlorofluorocarbons (HCFCs), hydrobromofluorocarbons (HBFCs) and methyl bromide. They are used as solvents, refrigerants, foam blowing agents, degreasing agents, aerosol propellants, fire extinguishers (halons) and agricultural pesticides (methyl bromide). The extent to which an ODS affects the ozone layer (its ODP) depends on its chemical characteristics. Some ODS, e.g. CFCs and HCFCs are also potent greenhouse gases;
- (c) **International agreements and targets:** The Vienna Convention for the Protection of

the Ozone Layer (1985) and its Montreal Protocol on Substances that Deplete the Ozone Layer (1987) and the London, Copenhagen, Montreal and Beijing amendments to the Montreal Protocol. The Montreal Protocol sets a target to eliminate the production and use of ODS. The list of substances is set forth in the Protocol and the amendments thereto.

3. *Methodology and guidelines*

(a) **Data collection and calculations:** Data collection should cover substances in annexes A to C or E of the Montreal Protocol, whether existing alone or in a mixture. It should include the isomers of any ODS, except as specified in the relevant annex, but exclude any controlled ODS or mixture which is in a manufactured product other than a container used for the transport or storage of that substance. Production means the amount of ODS produced, minus the amount destroyed by technologies to be approved by the Parties to the Montreal Protocol and minus the amount entirely used as feedstock in the manufacture of other chemicals. The amount recycled and reused is not to be considered as "production". Sale or consumption is the sum of production plus imports minus exports of ODS. Weighted tons of ODS for production is the sum of national annual production (in tons) of each ODS multiplied by its ODP. ODP is a relative index of the ability of a substance to cause ozone depletion. Data on sales or consumption are obtained through a similar calculation using national annual sale or consumption values (in tons);

(c) **Internationally agreed methodology and standards:** The UNEP Ozone Secretariat has developed data reporting forms for reporting under the Montreal Protocol and pursuant to decisions on requests for data by the Meeting of the Parties. These forms cover data reporting on imports, exports, production, amounts destroyed and on imports from and/or exports to non-Parties. The UNEP Handbook on Data Reporting under the Montreal Protocol assists the Parties to provide accurate, comprehensive and timely data.

4. **Data sources and reporting:** Data on production, imports and exports of ODS are generally collected annually by national statistical agencies and/or national focal points responsible for reporting under the Montreal Protocol. EECCA and other countries submit national ODS data to the UNEP Ozone Secretariat. EU members report data also to the European Commission in accordance with Council Regulation 2037/2000.

5. *Reference at the international level*

- Ozone Secretariat, UNEP, Handbook for the International Treaties for the Protection of the Ozone Layer, pp.367, 2000. (ISBN: 92- 807-1867-3).
- Handbook on Data Reporting under the Montreal Protocol. UNEP and Multilateral Fund for the Implementation of the Montreal Protocol, United Nations, 1999 (ISBN 92-807-1735-9).
- <http://www.unep.org/ozone>
- <http://www.unep.ch/ozone>
- <http://www.unmfs.org>
- <http://www.uneptie.org/ozonaction>
- <http://www.gefweb.org>
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- <http://www.undp.org/seed/eap/montreal/index.htm>