



**Economic and Social  
Council**

Distr.  
GENERAL

ECE/CEP/AC.10/2006/9  
3 April 2006

Original: ENGLISH

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**ECONOMIC COMMISSION FOR EUROPE**

**COMMITTEE ON ENVIRONMENTAL POLICY**

Working Group on Environmental Monitoring and Assessment

Sixth session

Geneva, 12–14 June 2006

Item 4 of the provisional agenda

**AGRICULTURE AND WASTE INDICATORS<sup>1</sup>**

**SUMMARY**

This document presents the descriptions of relevant indicators for the guidelines on the application of environmental indicators for Eastern Europe, the Caucasus and Central Asia (EECCA). For technical reasons, the descriptions of other indicators are contained in separate documents, as follows: introduction and climate change (ECE/CEP/AC.10/2006/6), air pollution and the ozone layer (CEP/AC.10/2005/4, annex II), water (ECE/CEP/AC.10/2006/7), water, land and biodiversity (ECE/CEP/AC.10/2006/8), energy and transport (ECE/CEP/AC.10/2006/10). The Working Group is expected to agree on the guidelines and submit them to the Committee on Environmental Policy for adoption.

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<sup>1</sup> Prepared by the secretariat on the basis of the outcome of the Workshop on the Application of Environmental Indicators held on 5–6 July 2004 in Chisinau, Republic of Moldova (CEP/AC.10/2005/4) and the decision taken by the Working Group on the matter at its fifth session (CEP/AC.10/2005/2, para. 23).

## ***FERTILIZER CONSUMPTION***

### ***General description***

1. **Brief description:** Total amount of fertilizers used per hectare of agricultural land.
2. **Measurement unit:** Kilogram per hectare.

### ***Relevance for environmental policy***

3. **Purpose:** The indicator provides a measure of the pressure on the environment in terms of intensity of fertilizer consumption.
4. **Issue:** The use of mineral fertilizers in agriculture to increase cropping power simultaneously increases environmental hazards, such as water and soil pollution, and has toxic effects on other environmental components, interfering with the natural balance of soil microflora. High levels of nitrate and nitrite in drinking water are a hazard to human health. The actual environmental effects will depend on pollution abatement practices, soil and plant types, and meteorological conditions. The indicator makes it possible to assess the fertilizer load on the environment (the accumulation of fertilizers in the soil, the resulting pollution of surface and groundwater, and the movement of fertilizers through trophic chains and other parts of the environment). Time series analysis of fertilizer consumption allows monitoring of its effect on the environment, which is influenced by geography and other local conditions, including the types of crops cultivated. Strategies can then be devised to offset any negative effects.
5. **International agreements and targets:** EU Directive 91/676/EEC, which concerns water pollution by nitrates, establishes requirements covering the use of nitrogen and phosphate. HELCOM (the Helsinki Commission) has developed recommendations for its Parties in this regard.

### ***Methodology and guidelines***

6. **Data collection and calculations:** It is necessary to collect data on fertilizer sales and fertilizers' basic characteristics. The indicator is assessed annually. Data on the quantities of fertilizers used (sales to the final consumer) are converted into the three basic nutrient components (N, K<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>) and aggregated. Basic data on fertilizer nutrient content can be obtained directly from producers or through chemical analysis. Agricultural land is defined according to cadastre information. The technical parameters of fertilizer application, such as the amount used, the climate zone, the season and broadcast method and the type of crop and soil, determine its effect on the environment. These factors, with the exception of the type of crop, are difficult to evaluate. No information is collected on natural fertilizers such as compost, manure and bone meal. Likewise, no information is collected on the use of fertilizers outside of agriculture. No consideration is given to "technical additives" normally present in fertilizers, such as radioactive content in phosphate fertilizers, which varies depending on the source of the phosphate rock.

7. **Internationally agreed methodologies and standards:** ISO standards (17020 for sampling and 17025 for testing).

*Data sources and reporting*

8. At the international level, the FAOSTAT database. At the national level, data are available from ministries dealing with agriculture and the environment and from statistical agencies.

*References at the international level*

- Fertilizer use by crop, 3. International Fertilizer Industry Association, Paris, France/International Fertilizer Development Center, Muscle Shoals AL, USA/FAO, Rome, Italy. Statistics Division, FAO, 1996. 49 p.
- Environmental Indicators for Agriculture. Vol. 3. Methods and Results. (OECD, 2001)
- Wascher, D.W. (ed.). Agri-Environmental Indicators for Sustainable Agriculture in Europe. ECNC Technical Reports series. (European Centre for Nature Conservation, 2000)
- *Towards Sustainable Agriculture – A Pilot Set of Indicators*. Research Report. (MAFF, 2000)
- FAO, FAOSTAT database, annual updates (Rome)
- Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC)
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://faostat.fao.org>
- <http://europa.eu.int/comm/eurostat/>
- <http://www.oecd.org/env/>
- <http://www.fertilizer.org/>
- <http://www.brinkman.be/brinkcgipage.cgi?|=e&t=h>
- <http://www.defra.gov.uk/farm/sustain/pilotind.pdf>
- <http://www.helcom.fi/>
- <http://www.unece.org/env/europe/monitoring/EnvMonRep/index.html>

**PESTICIDE CONSUMPTION**

*General description*

9. **Brief description:** Use of pesticides per unit of agricultural land area.

10. **Measurement unit:** Kilogram of active substance per hectare.

*Relevance for environmental policy*

11. **Purpose:** The indicator provides a measure of the pressure on the environment in terms of intensity of pesticide consumption.

12. **Issue:** The use of pesticides (herbicides, fungicides, etc.) for crop protection or other purposes increases environmental hazards (soil pollution and toxic effects on other parts of the environment). Pesticides can be persistent, mobile and toxic in soil, water and air, and they can

affect humans and wildlife through the food chain. They tend to accumulate in the soil and in biota, and residues may reach surface water and groundwater through leaching. Data on the use of pesticides makes it possible to assess the resulting environmental hazards for various regions, separate territories and crops. Time series analysis of pesticide consumption allows monitoring of its effect on the environment, which is influenced by geography and other local conditions, including the types of crops cultivated. Strategies can then be devised to offset any negative effects.

**13. International agreements and targets:** The 2001 Convention on Persistent Organic Pollutants (POPs) and the POPs Protocol to the 1979 Convention on Long-range Transboundary Air Pollution control the use of pesticides. Some pesticides are banned by international trade agreements. Since 1993 the European Union has been implementing a programme to establish harmonized maximum residue levels (MRLs), which restrict the levels of pesticide residues in foodstuffs sold in the European Union.

#### *Methodology and guidelines*

**14. Data collection and calculations:** Data calculation is based on the amount of pesticide sales (sales volume). Data are continuously fed into national databases on pesticide consumption. Pesticide consumption is assessed annually. At the national level, government authorities monitor pesticide consumption by pesticide groups: insecticides, herbicides, fungicides and so on. Pesticide databases should describe pesticide characteristics, such as active components, the toxic level and persistence. An analysis of pesticides' effect on the environment that is based solely on the amount of active components present cannot be considered complete. It is important to take into account factors such as broadcast methods, the climate, the season, and the types of soil and cultivated crop. A toxic coefficient cannot compensate for the data limitations described above. To date there is no commonly accepted toxic scale; besides, no data are collected on pesticides' persistence or their accumulation in agricultural soil and produce.

**15. Internationally agreed methodologies and standards:** The Organisation for Economic Co-operation and Development (OECD) collects data on the amount of active component, while European Union attempted to introduce a toxic coefficient for all types of pesticides, which would allow harmonizing analysis and applying a single indicator.

#### *Data sources and reporting*

16. Some data on total national pesticide use are available from the Food and Agriculture Organization of the United Nations (FAO) and the OECD. Eurostat maintains a database of member countries' data. Pesticide Action Network North America (PANNA) also has a database. At the national level, data are available from ministries dealing with agriculture and the environment and state statistical agencies.

#### *References at the international level*

- FAO, FAOSTAT database, annual updates. (Rome)
- Council Directive 76/895/EEC establishing MRLs for selected fruits and vegetables
- Council Directive 86/362/EEC establishing MRLs for cereals and cereal products

- Council Directive 86/363/EEC establishing MRLs in products of animal origin
- Council Directive 90/642/EEC establishing MRLs in products of plant origin, including fruits and vegetables
- Regulation (EC) No. 396/2005 of the European Parliament and of the Council of 23 February 2005 on MRLs of pesticides in products of plant and animal origin
- *Environmental Indicators for Agriculture. Vol. 3. Methods and Results.* (OECD, 2001)
- Wascher, D.W. (ed.). *Agri-Environmental Indicators for Sustainable Agriculture in Europe.* ECNC Technical Reports series. (European Centre for Nature Conservation, 2000)
- U.S. Department of Agriculture, Agricultural Marketing Service. *Pesticide Data Program: Annual Summary Calendar Year 2000.* (U.S. Department of Agriculture, February 2002)
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://www.fao.org/>
- <http://europa.eu.int/comm/eurostat/>
- <http://www.pops.int/>
- <http://www.pesticideinfo.org/Index.html>
- <http://www.epa.gov/tri/>

## **WASTE GENERATION**

### ***General description***

17. **Brief definition:** The amount of generated waste in a country – total, per unit of gross domestic product (GDP), and by category (industrial, municipal (solid) and hazardous).

18. **Measurement unit:** Thousand metric tons per year and metric tons per year for hazardous waste. Total waste intensity should be presented in kilograms per unit of GDP at constant prices (in both US\$ and the national currency), and municipal waste intensity should be expressed in kilograms per capita.

### ***Relevance for environmental policy***

19. **Purpose:** The main purpose is to provide a measure of the pressure on the environment of the total amount of generated waste and waste by category (hazardous, industrial and municipal solid waste). The waste intensity represents a driving force indicator and shows response to the eco-efficiency of human activities. Waste generated per unit of GDP will show if there has been any decoupling of waste generation from economic growth. Municipal waste generation per capita allows comparisons of countries with similar economies. For each indicator, the two time series should be shown together to get the full benefit of the indicator.

20. **Issue:** Sound and efficient use of natural resources is an important part of sustainable development. Waste represents a considerable loss of resources in the form of both materials and energy. The treatment and disposal of the generated waste may cause environmental pollution and expose humans to harmful substances and bacteria, there by affecting human health. Waste generation is intimately linked to the level of economic activity in a country. It reflects society's

production and consumption patterns, and wealthier economies tend to produce more waste. A reduction in the volume of waste generated is an indication of development towards less material-intensive production and consumption patterns, particularly as an economy moves from a heavy industry base to a more service-oriented base.

21. **International agreements and targets:** Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal agreed to take all practicable steps to ensure minimization of the generation of hazardous and other waste. Agenda 21, chapter 20 on general objectives includes the target of “preventing or minimizing the generation of hazardous wastes as part of an overall integrated cleaner production approach” (20.7). Some countries have set national targets for the reduction of waste within a specified time frame.

### *Methodology and guidelines*

22. **Data collection and calculations:** The precise definition of what constitutes waste varies, but principally waste can be considered materials that are not prime products (products produced for the market), for which the generator has no further use related to production, transformation or consumption, and which the generator discards, or intends to or is required to discard. It excludes residuals directly recycled or reused on the site of generation and pollutants that are directly discharged into ambient water or air as wastewater or air emission. Waste statistics should group waste according to main economic activities and should use the International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 3. **Industrial waste** covers waste generated primarily by mining and quarrying, by manufacturing industries and by energy production and construction. Waste from industrial activities that is removed by municipal waste collection should be reported under the respective sector of generation.

**Municipal (solid) waste** includes all municipal waste collected plus the estimated amount of municipal waste from areas not served by a municipal waste collection service. In general it covers waste originating from households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). Data on municipal waste generation are usually gathered through surveys of municipalities, which are responsible for waste collection and disposal, or from transport companies that collect waste, or from landfill or incineration sites. The amount reported under “**total waste generation**” should be equal to the sum of the waste amounts reported as industrial waste, waste generated by other economic activities (e.g. agriculture and forestry) and municipal waste. **Hazardous waste** should cover the categories of waste to be controlled according to the Basel Convention (Article 1 and Annex I).

23. **Internationally agreed methodologies and standards:** The UNSD/UNEP Questionnaire on Environment Statistics, coordinated with a joint OECD/Eurostat questionnaire, provides a methodology for calculating waste generation by sector. The Basel Convention has established an internationally agreed methodology for calculating the amount of hazardous waste generated.

### *Data sources and reporting*

24. The Basel Convention requires information on internationally agreed types of hazardous waste. At the national level, sources of data include ministries responsible for urban affairs and the environment, as well as statistical agencies. EECCA countries reported waste generation data

for the *Kiev Assessment* report and to UNSD in response to the UNSD/UNEP Questionnaire on Environment Statistics.

### ***References at the international level***

- UNSD/UNEP 2006 Questionnaire on Environment Statistics (waste section)
- Basel Convention for the Control of Transboundary Movement of Hazardous Wastes and Their Disposal
- United Nations. *International Standard Industrial Classification of All Economic Activities*. Series M No.4, Rev.3
- European Environment Agency. *Europe's Environment: The Third Assessment*. (EEA, 2003) (Kiev Assessment)
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://unstats.un.org/unsd/environment/questionnaire2006.htm>
- <http://www.basel.int/>
- <http://www.unep.org>
- [http://themes.eea.eu.int/Environmental\\_issues/waste/indicators](http://themes.eea.eu.int/Environmental_issues/waste/indicators)
- <http://themes.eea.eu.int/IMS/CSI>
- <http://waste.eionet.eu.int/>
- <http://www.etc-waste.int/>
- <http://europa.eu.int/comm/eurostat/>
- <http://www.oecd.org>

## ***TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES***

### ***General description***

25. **Brief definition:** The total amount of hazardous waste, as defined by the Basel Convention, exported and imported by a country.

26. **Unit of measurement:** Metric tons per year.

### ***Relevance for environmental policy***

27. **Purpose:** The transboundary movement of hazardous waste represents a driving force indicator demonstrating transboundary movements of hazardous wastes. Trends in a country's export of hazardous waste show its response to the need to minimize the generation of hazardous waste and recycle it domestically.

28. **Issue:** Toxic, poisonous, explosive, corrosive, flammable, ecotoxic and infectious waste are recognized as hazardous waste. The uncontrolled movement and dumping of this waste can cause severe health problems and can poison water and land for decades. Recycling of hazardous waste reduces the need for its transboundary movement and prevents risks to human health and the environment. In some instances transboundary movement is required for ecologically safe waste recovery and disposal. Transboundary hazardous waste movement may also be justified

when waste is going to be used as secondary raw material or for energy generation. Complete data on the export and import of hazardous waste help to control its safe movement and disposal.

**29. International agreements and targets:** The Conference of the Parties to the Basel Convention, at its second meeting, banned transboundary movement of hazardous waste from Annex VII countries (EU, OECD and Liechtenstein) to non-Annex VII countries (resolution II/12). The third meeting of the Conference of the Parties amended the above resolution (resolution III/1). The Basel Convention does not provide any internationally agreed targets for the containment and reduction of transboundary movement of hazardous waste.

### *Methodology and guidelines*

**30. Data collection and calculations:** The amount of exported hazardous waste should be assessed by the exporter and data entries made in special transboundary transit notices as required by Article 6 of the Basel Convention. Data should be recorded on the amount, category and nature of each type of waste (whether hazardous or not) subject to transboundary movement. Data should be available on a continuous basis through the application at the national level of notification and monitoring procedures for transboundary waste movement. Developed-country Parties to the Basel Convention have long adopted and use such procedures. However, most developing countries do not have these procedures. The difficulty of establishing whether a particular waste is hazardous leads to problems in using waste information as an indicator of sustainable development. A special technical working group created under the Basel Convention was entrusted with determining which types of waste should be considered hazardous under the convention (Decision III/1 of the third meeting of the Conference of the Parties). The same working group categorized waste into types, which should be considered as waste under all and any circumstances, and other types which are not subject to the Convention. Data scarcity, imprecision and lack of systematic categorization are other limitations of this indicator. Illegal trade of hazardous waste poses additional problems.

**31. Internationally agreed methodology and standards:** Article 5 of the Basel Convention requires that Parties establish competent bodies and appoint a responsible official in the area of hazardous waste. The competent body is responsible for collecting information on the export and import of hazardous waste, among other things. The seventh meeting of the Conference of the Parties to the Basel Convention adopted a decision on harmonization of lists of wastes and related procedures.

### *Data sources and reporting*

**32.** Most EECCA countries that are Parties to the Basel Convention report annually on the generation, export and import of hazardous wastes covered by the Convention. This information is reviewed and compiled by the secretariat and is presented in an annual report, which includes statistical tables and graphic representations of the data.

### *References at the international level*

- Manual: Questionnaire on "Transmission of Information". (Basel Convention for the Control of Transboundary Movement of Hazardous Wastes and Their Disposal).

- <http://www.basel.int/>
- <http://unstats.un.org/unsd/environment/>
- <http://www.un.org/esa/susdev/natinfo/indicator.htm>
- <http://waste.eionet.eu.int/>
- [http://themes.eea.eu.int/Environmental\\_issues/waste/indicators](http://themes.eea.eu.int/Environmental_issues/waste/indicators)
- <http://www.oecd.org/env/>
- <http://www.environmentalindicators.com>
- <http://reports.eea.eu.int>
- <http://europa.eu.int/comm/eurostat/>

## **WASTE RECYCLING**

### ***General description***

33. **Brief definition:** Waste recycled as a share of the total waste in a country, or of the specific category of waste (industrial, municipal or hazardous).
34. Unit of measurement: Percentage.

### ***Relevance for environmental policy***

35. **Purpose:** Waste recycling represents a response type indicator and shows the proportion of total waste, or of the specific category of waste, that is recycled.
36. **Issue:** Waste recycling is an important component of sustainable use of resources. Solid waste recycling is an important component of sustainable solid waste management. As the population continues to grow, the amount of land available for waste disposal is reduced and waste has to be transported longer distances. When waste recycling is stimulated, landfill capacity is conserved and solid waste management expenditures are reduced. Increased recycling leads to a reduction in the environmental impacts of waste disposal, such as methane and carbon dioxide gas emissions from landfill sites, and it preserves natural resources. Recycling also tends to increase the population's income through employment in the system of waste recycling.
37. **International agreements and targets:** No international agreement or targets exist. EU Directive 94/62/EC on packaging and packaging waste requires member countries to recycle a minimum of 55% and a maximum of 80% of packaging waste by 2008.

### ***Methodology and guidelines***

38. **Data collection and calculations:** Recycling is defined as any reprocessing of waste material in a production process that diverts it from the waste stream, except reuse as fuel. Reprocessing as the same type of product and for different purposes should both be included. Recycling in industrial plants (i.e. at the place of generation) should be excluded. Assessment of recycled waste requires precise assessment of total waste and the specific category of waste (industrial, municipal or hazardous). The indicator of waste recycling is derived by dividing the

quantity of total and specific-category waste recycled by the total quantity of waste and specific-category waste generated and expressing the result as a percentage. In addition, the proportion of recycled waste may be presented as a percentage of recycled components, such as metals, plastic, paper, glass, textiles or organic materials.

39. **Internationally agreed methodology and standards:** The UNSD/UNEP Questionnaire on Environment Statistics, coordinated with a joint OECD/Eurostat questionnaire, provides a methodology for calculation of waste recycling.

#### *Data sources and reporting*

40. At the national level, data sources include ministries responsible for urban affairs and the environment and statistical agencies. EECCA countries reported waste recycling data for the *Kiev Assessment* report.

#### *References at the international level*

- European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
- <http://unstats.un.org/unsd/environment/datacollect.htm>
- <http://europa.eu.int/comm/eurostat/>
- <http://waste.eionet.eu.int/>
- [http://themes.eea.eu.int/Environmental\\_issues/waste/indicators](http://themes.eea.eu.int/Environmental_issues/waste/indicators)
- <http://www.oecd.org/env/>
- <http://www.unhabitat.org>

### **FINAL WASTE DISPOSAL**

#### *General description*

41. **Brief definition:** The share of the total volume of waste generated (the latter also broken down by category – industrial, municipal and hazardous) that is finally disposed of by (a) incineration or (b) landfilling on a controlled site.

42. Measurement unit: Percentage.

#### *Relevance for environmental policy*

43. **Purpose:** The indicator provides a measure of the pressure on the environment and the response to the efficiency of the waste management system.

44. **Issue:** The way a country manages its solid waste has significant long-term implications for public health, the economy and the natural environment. Therefore it is essential to promote an environmentally sound solid waste treatment and disposal programme. Generally, adequate waste management indicates that the authorities are aware of the health and environmental risks

and that they support or impose suitable measures to prevent or reduce waste. Reducing the amount of waste that needs to be disposed of in turn reduces the demand for raw materials, leading to a reduction in resource extraction. For waste that is not suitable for recycling, incineration is often considered the next-best option, if the incineration plants comply with legislation for emission standards and if energy from waste incineration is recovered, as it reduces the overall volume of waste. If recycling or incineration is excluded, waste should be landfilled on a controlled site, with suitable technical control in line with national legislation. Controlled landfilling requires adherence to a permit system and technical control procedures in compliance with the national legislation in force. Other final disposal methods may include permanent storage.

45. International agreements and targets: None.

### ***Methodology and guidelines***

46. **Data collection and calculations:** To measure the proportion of waste disposed of by different methods, a combination of several methods can be used. It is important to be aware of where in the waste flow the data are collected so as to avoid double counting. Municipalities or industries should have data about waste that they manage. Also, waste management and disposal facilities such as incineration plants and landfills should be aware of the amounts they are processing. Waste collection companies are another potential source of data. However, data can be scattered, and its collection and compilation for indicator purposes can be time-consuming. For practical reasons, calculation of the waste incineration rate should consider only waste incinerated through the registered waste management system. Households or industries incinerating their own waste should not be included. Calculation of the landfill rate usually does not consider waste disposed of at illegal dumps.

47. **Internationally agreed methodologies and standards:** The UNSD/UNEP Questionnaire on Environment Statistics, coordinated with a joint OECD/Eurostat questionnaire, provides a methodology for calculation of waste recycling.

### ***Data sources and reporting***

48. At the national level, data sources include ministries responsible for urban affairs and environment and statistical agencies. EECCA countries reported waste disposal data for the *Kiev Assessment* report.

*References at the international level*

- UNSD/UNEP 2006 Questionnaire on Environment Statistics (waste section)
- United Nations. *International Standard Industrial Classification of All Economic Activities*. Series M No.4, Rev.3
- European Environment Agency. *Europe's Environment: The Third Assessment* (EEA, 2003) (Kiev Assessment)
- <http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm>
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- <http://www.basel.int/>
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- [http://themes.eea.eu.int/Environmental\\_issues/waste/indicators](http://themes.eea.eu.int/Environmental_issues/waste/indicators)
- <http://themes.eea.eu.int/IMS/CSI>
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- <http://www.oecd.org>