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**WASTE DATA AND CLASSIFICATIONS:
TOWARDS A HIERARCHY OF INDICATORS ON WASTE AND MATERIAL FLOWS**

Discussion paper by the European Environment Agency (EEA)¹

1. The reporting mechanism of EEA is currently based on the use of indicators as the tool needed by policy makers on environmental issues, in order to transform “data” into “information”, which then can be used as meaningful basis for policy making.
2. Concerning the field of waste/material flows, work on the development of a comprehensive framework for the preparation of respective indicators is on-going and, as explained further below, will be based on the 6th Environmental Action Programme (EAP), which sets-up the overall policy context in the European Union countries. However, the major policy questions addressed here and included in the 6th EAP, do not differ, to a large extent, from the considerations of policy makers in other UNECE countries. Therefore this broad context could be useful for authorities in countries in transition dealing with waste issues as well.
3. The work is developed by the European Topic Centre on waste and material flows (ETC/WMF), a partner of EEA specialized in the relevant issues. It is being prepared under EEA supervision, coordination and guidance. The definition of indicators was still ongoing at the time of the preparation of this paper. Therefore the information contained here is preliminary.
4. For the newly Independent States (NIS) and other UNECE countries that are not covered by EEA networks it might be of particular interest to understand the concept of indicator development that EEA is currently adopting, to define whether it fits into the actual needs of the countries and to find out which waste data can be obtained at the national level needed for the

¹ This document was not formally edited.

production of the relevant indicators. In particular the following questions should be asked:

- Which are the priorities for indicator development and use?
- Which indicator subsets are meaningful in a specific country context and can be used in practice?
- What changes should be made in the indicator selection to match the country's needs?
- Do existing data sets in non-EEA countries fit into the proposed indicator framework?

5. The annex to this paper contains a hierarchy of indicators on waste and material flows containing the main policy objectives, main policy questions asked, key, core and elemental indicators respective to each question.

I. OBJECTIVE OF THE WORK ON A HIERARCHY OF INDICATORS ON WASTE AND MATERIAL FLOWS

6. The purpose of this work is to identify, develop and define the indicators to be used in regular reporting by EEA on progress made regarding waste prevention, waste management and material flows. Thus, the objective is to develop:

- A core set of indicators on waste and material flows in a clear hierarchy related to policy objectives and questions;
- Core indicators linking economic activities with material flows and waste generation; and
- Appropriate indicators to facilitate an adequate policy assessment (in cooperation with other bodies concerned (the European Commission (EC), national authorities etc.).

7. The on-going activities in the short term are:

- Preparation of an indicator framework on waste and material flows (technical report);
- Prioritization of policy questions and relevant indicators needed for the assessment of the main issues concerned and described in the indicator framework;
- Coordination of activities for the development of indicators with the EC Directorate-General (DG) Environment and Eurostat; and
- Identification of data availability for each indicator.

8. The work is inspired by the ideas and the framework developed in the Transport and Environment Reporting Mechanism (TERM), and the first step in our process is the identification of relevant policy questions and corresponding indicators.

9. The starting point for developing these indicators has been the policy objectives and targets identified in the EU Sustainable Development Strategy, the 6th EAP, the EU Waste Strategy and Directives. A large body of indicators to choose from has been developed by the EEA, EC, Eurostat, OECD, the United Nations and Member States, as well as the data and statistics collected with regard to waste and material flows. The Driving Force - Pressure - State - Impact - Response conceptual framework (DPSIR) developed by EEA has been used to structure the indicators.

II. POLICY CONTEXT

10. The EC initially adopted a Community Strategy for Waste Management in 1989. The strategy sets out four strategic guidelines (waste hierarchy): prevention; re-use and recovery; optimization of final disposal; and regulation of transport, together with a number of recommended actions. The main strategic guidelines were maintained in the 1996 Review of the Community Strategy for Waste Management, adding that preference should, in general, be given to the recovery of material over energy recovery.

11. The 6th EAP sets out major priorities and objectives for environmental policy over the next 5 to 10 years. One of four 'priority areas' within the 6th EAP is "Sustainable Use of Natural Resources and Management of Wastes". The 6th EAP identifies the following objectives within this priority area:

- "To ensure that the consumption of renewable and non-renewable resources and the associated impacts do not exceed the carrying capacity of the environment and to achieve a de-coupling of resource use from economic growth through significantly improved resource efficiency, dematerialization of the economy, and waste prevention.
- To de-couple the generation of waste from economic growth and achieve a significant overall reduction in the volumes of waste generated through improved waste prevention initiatives, better resource efficiency, and a shift to more sustainable consumption patterns, and,"

for wastes that are still generated, to achieve a situation where:

- "the wastes are non-hazardous or at least present only very low risks to the environment and our health;
- the majority of the wastes are either reintroduced into the economic cycle, especially by recycling, or are returned to the environment in a useful (e.g. composting) or harmless form;
- the quantities of waste that still need to go to final disposal are reduced to an absolute minimum and are safely destroyed or disposed of; and
- waste is treated as closely as possible to where it is generated."

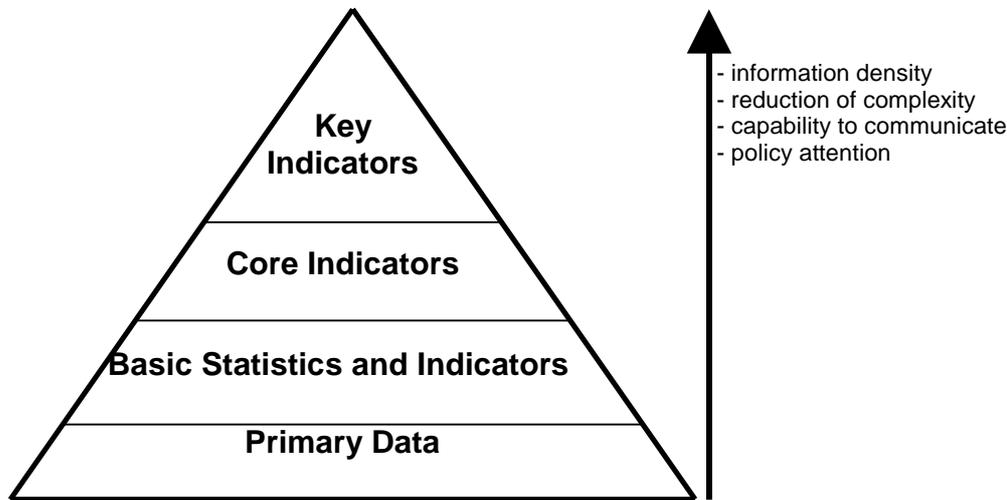
12. The importance of work on indicators on waste and material flows is emphasized specifically in the 6th EAP: "*A lack of aggregate data at the EU level makes it difficult to assess whether the environmental impacts associated with management of wastes are improving or deteriorating*"

13. It is stated in the 6th EAP that although many of the existing policy measures affect the use of renewable and non-renewable natural resources, the Community still "...*lacks a coherent policy focused on achieving an overall de-coupling of resource use from economic growth*". Thus, it identifies the "*need to develop a Thematic Strategy on the sustainable use of resources*". As waste prevention is closely linked with improving resource efficiency, it "*will be a key part of the planned thematic strategy on resource management*". It is hoped that the work to develop a hierarchy of indicators on waste and material flows can provide a useful input and a starting point in the development of this Strategy.

III. THE INFORMATION PYRAMID

14. Environmental policymaking is based on large amounts of quantitative and qualitative

information. Quantitative information related to waste and material flows can be provided at different levels and one can talk about something often referred to as the information pyramid:



15. Information for the broad public and high-level policymakers forms the top of the pyramid. At this level, highly aggregated quantitative information related to waste and material flows can be provided through highly condensed key indicators. It seems desirable to identify or develop three to four key indicators with a high information density indicating to which extent policy objectives or targets related to the sustainable use of natural resources and management of wastes are reached. However, key indicators constitute only one building block of a more comprehensive and broad information system.

16. A set of more detailed indicators is needed to give answers to more concrete policy questions in the field of waste and material flows, and in order to identify priority actions. This set can be called a core set of indicators on waste and material flows which can be used for regular EEA and ETC/WMF reporting and integrated assessments in order to provide information for the public and the policy making process on waste and material flows.

17. Consistent and timely basic statistics and elemental indicators form a third level. Basic statistics are frameworks or schemes presenting primary statistics in a structured way. Elemental indicators present a low aggregation level of information giving answer to fundamental questions, helping in monitoring and addressing detailed policy measures.

18. Primary data constitute the fourth level and the building block of the information system at the bottom of the information pyramid.

19. Building a hierarchy of indicators on waste and material flows, using all levels of the information pyramid, can help bridging the gap between the data collected and the information needed by policymakers.

IV. THE ETC/WMF DRAFT HIERARCHY OF INDICATORS

20. During the development of a draft hierarchy of indicators on waste and material flows, it

was found that indicators need to be policy relevant, and that each indicator should be directly related to policy objectives identified in EU policy documents. Thus, in identifying the indicators, the first step was the identification of EU policy objectives related to waste and material flows against which policy performance can be monitored. The following three overall policy objectives have been identified:

- (a) Sustainable use of natural resources;
- (b) Prevent waste generation;
- (c) Sustainable waste management.

21. For each of these, an overall policy question has been identified based on the reading of major EU policy documents (6th EAP, waste directives etc.). For each question, a key indicator is proposed for provision of an answer to the policy question.

22. Furthermore, for each of the three overall policy objectives, a number of specific policy questions that directly relate to EU policy documents (strategies and directives) have been identified. These specific policy questions do not represent an attempt to cover all policies identified in EU strategies and directives, but are an attempt to summarize the policy objectives in the strategies and directives in a few simple and unambiguous policy questions.

23. The identification of these policy questions is an important step in the identification of a limited number of core indicators on waste and material flows for EEA reporting. For each of the specific policy questions, one or two core indicators are identified which can provide an answer or an indication of an answer to the policy question identified. Thereby, the 16 proposed core indicators measure the implementation of the main objectives agreed in EU strategies and objectives related to waste and material flows.

24. The availability and quality of the data for the core indicators is of utmost importance if the core indicators are to provide a basis for the future EEA reporting related to waste and material flows. Therefore, an assessment has been done of the availability of the data for each core indicator, distinguishing between those which are available in the short term (1-2 years), those expected to be available in the medium term (2-5 years), and those expected to be available in the long term (more than 5 years).

25. To support the 16 core indicators for waste and material flows, a number of elemental indicators or statistics are identified for each of the policy questions. These elemental indicators can provide a supplement to the core indicators and can provide information that are relevant, but which are perhaps not 'core' to the questions, or can provide information at a more detailed level than the core indicators.

26. In general, data availability in the field of waste and material flows is insufficient and there is a need to "bridge the gap" between the current data available and the information needed for policymaking. Current data collection systems in EU Member States differ, and derived indicators are often not comparable. Significant improvements towards harmonized and

standardized waste statistics will be achieved through the EU proposed “Waste Statistics Regulation” The first results are, however, not foreseen to be available before the year 2006.

27. In the meantime, ETC/WMF will need statistics for the EEA indicator-based reports. This means that priority is given to statistics compiled by Eurostat/OECD, combined with other official EU-sources, and for non-EU countries by UNECE. Only few statistical offices produce regular statistics on material flow accounting (MFA). In order to harmonize methodologies, Eurostat has published a methodological guide, which aims at encouraging national statistical authorities to establish MFA statistics.

Annex**HIERARCHY OF INDICATORS ON WASTE AND MATERIAL FLOWS**

POLICY OBJECTIVE 1: SUSTAINABLE USE OF NATURAL RESOURCES				
MAIN POLICY QUESTION: ARE WE REDUCING THE TOTAL RESOURCE USE AND THE POTENTIAL PRESSURES ON THE ENVIRONMENT AND WASTE GENERATION?			KEY INDICATOR (1ST LEVEL INDICATOR): TOTAL MATERIAL REQUIREMENT (Tonnes per capita)	
Policy question(s)	Policy Document(s) and major quantitative targets	Core Indicator(s) (2nd level indicators)	Type of indicator, data available	Elemental Indicators (3rd level indicators)
1.a) Are we reducing the consumption of the resources that are of most concern?	<ul style="list-style-type: none"> • 6EAP • 5EAP • Waste Management Strategy 	<ul style="list-style-type: none"> • Total Material Requirement (TMR) by main resource categories 	<ul style="list-style-type: none"> • Pressure indicator, short term 	<ul style="list-style-type: none"> • Share of non-renewable and renewable resources in TMR • Share of imported resources in TMR • Actual vs. sustainable use-rates of renewable resources (main categories e.g. fish, forests, etc.)
1.b) Are we reducing the environmental pressures associated with the extraction of resources?	<ul style="list-style-type: none"> • 6EAP • 5EAP 	<ul style="list-style-type: none"> • GHG emissions, land and water use and waste generation from total resource extraction (indicator to be developed) 	<ul style="list-style-type: none"> • Pressure indicator, medium term 	<ul style="list-style-type: none"> • By resource extracting sectors (NACE 2-digit: emissions of greenhouse gases, acidifying substances and ozone precursor substances, generation of waste, water use, land-use, emissions to water)
1.c) Are we de-coupling resource use from economic growth?	<ul style="list-style-type: none"> • 6EAP 	<ul style="list-style-type: none"> • Resource productivity (GDP/TMR) 	<ul style="list-style-type: none"> • Driving force indicator, short term 	<ul style="list-style-type: none"> • Gross value added (or production index, electricity produced, etc.) over TMR by sectors (NACE 2-digit-level)
1.d) Which policies have been implemented in order to use resources more sustainable?	<ul style="list-style-type: none"> • 6EAP 	<ul style="list-style-type: none"> • Indicator to be developed 	<ul style="list-style-type: none"> • Response indicator, long term 	<ul style="list-style-type: none"> • Revenue from taxes and tax rates on natural resources and products, ratio to value added in natural resource sectors • R&D expenditures addressing resource efficiency of products and processes • Subsidies on extracting and using natural resources by sector • Indicator for effects on resource use of waste prevention and management to be developed • Gains in material efficiency of selected products and processes or key innovations reducing material use • Share of recycled (secondary) materials in total consumption of virgin (primary) materials (selected) • Raw material prices in real terms (by main categories)

POLICY OBJECTIVE 2: PREVENT WASTE GENERATION				
OVERALL POLICY QUESTION:		KEY INDICATOR (1ST LEVEL INDICATOR):		
ARE WE PREVENTING THE GENERATION OF WASTE?		GENERATION OF TOTAL WASTE AND HAZARDOUS WASTE PER CAPITA		
Policy question(s)	Policy document(s) and major quantitative targets	Core Indicator(s) (2nd level indicators)	Type of indicator /data avail.	Elemental Indicators (3rd level indicators)
2.a) Is the quantity of priority waste streams decreasing?	<ul style="list-style-type: none"> 6EAP: (p. 53): 'Reduce volumes of hazardous waste generated by around 20% by 2010 compared to 2000 and in the order of 50% by 2020' Waste Management Strategy End-of-Life Vehicles Directive Packaging Directives Draft Waste of Electrical and Electronic Equipment (WEEE) Directive 	<ul style="list-style-type: none"> Generation of priority waste streams per capita² (total and by waste stream) 	<ul style="list-style-type: none"> Pressure indicator, long term 	<ul style="list-style-type: none"> Total generation of waste by main categories Distance to prevention targets for priority waste streams Packaging intensity indexes of production and consumption
2.b) Is the content of dangerous substances in priority waste streams decreasing?	<ul style="list-style-type: none"> End-of-Life Vehicles Directive Packaging Directives Sewage Sludge Directive Directive on polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT) Batteries Directive Waste Oil Directive Draft WEEE Directive 	<ul style="list-style-type: none"> Content of dangerous substances in products which end up in priority waste streams (ratio to total material content) 	<ul style="list-style-type: none"> Pressure indicator, long term 	<ul style="list-style-type: none"> Content of dangerous substances in waste streams
2.c) Are we decoupling waste generation from economic growth?	<ul style="list-style-type: none"> 6EAP 	<ul style="list-style-type: none"> Waste intensity (total waste generated per unit of GDP) 	<ul style="list-style-type: none"> Driving force indicator, short term, Waste Statistics Regulation (WSR) 	<ul style="list-style-type: none"> Household waste generated per unit of private final consumption Industrial waste per unit of index of industrial prod. Hazardous waste generated per unit of GDP Waste generated per unit of gross value added in main economic sectors
2.d) Which policies have been implemented to prevent waste generation?	<ul style="list-style-type: none"> 6EAP Waste Management Strategy Integrated Pollution Prevention and Control (IPPC) Directive Integrated Pollution Prevention (IPP) Strategy 	<ul style="list-style-type: none"> Indicator to be defined 	<ul style="list-style-type: none"> Response indicator, long term 	<ul style="list-style-type: none"> Revenues from taxes on products and waste and levels of tax per unit Share of total waste generation addressed by policy measures Number of administrations adopting waste prevention programmes Number of companies adopting Eco-Management and Audit Scheme (EMAS) certification

² Priority waste streams could be defined as waste streams which are "targeted" by EU policy documents: hazardous waste; municipal waste; packaging waste; end of life vehicles (used tyres); healthcare waste; construction and demolition waste; waste from electrical and electronic equipment (incl. batteries and accumulators); sewage sludge; and waste oil.

POLICY OBJECTIVE 3: SUSTAINABLE WASTE MANAGEMENT				
OVERALL POLICY QUESTIONS: ARE WE MANAGING OUR WASTE MORE SUSTAINABLE?		KEY INDICATOR (1 ST LEVEL INDICATOR): SHARE OF TOTAL WASTE RECOVERED		
Policy question(s)	Policy documents and major quantitative targets	Core Indicator(s) (2 nd level indicators)	Type of indicator data avail.	Elemental Indicators (3 rd level indicators)
3.a) Are we improving the recovery of waste?	<ul style="list-style-type: none"> • 6EAP • 5 EAP Recycle/reuse of paper, glass and plastics at 50% • Waste Management Strategy • Waste Framework, Waste Incineration, Packaging, Landfill, Batteries, Waste Oil, Sewage Sludge and Hazardous Waste Directives 	<ul style="list-style-type: none"> • Waste recovery by operation categories 	<ul style="list-style-type: none"> • Response indicator, short term 	<ul style="list-style-type: none"> • Ratio of recycled material related to the total amount of waste generated • Waste recovery by operation categories for each Directive • Distance from recovery/recycling targets for priority waste streams
3.b) Are we disposing waste in a sustainable way?	<ul style="list-style-type: none"> • 6EAP: Reduce the quantity of waste going to final disposal by around 20% by 2010 compared to 2000, and in the order of 50% by 2020 • 5EAP: Considerable reduction of dioxin emissions (90% reduction on 1985 levels by 2005) • Waste Framework, IPPC, PCB/PCT, Waste Oil, Waste Incineration and Landfill Directives 	<ul style="list-style-type: none"> • Waste disposal (total and by operation categories) 	<ul style="list-style-type: none"> • Pressure indicator, short term (WSR) 	<ul style="list-style-type: none"> • Amount or share of waste disposed according to requirements of Directives • Emissions of hazardous substances from waste facilities
3.c) Are we reducing the environmental pressures from waste recovery and disposal?	<ul style="list-style-type: none"> • 6EAP 	<ul style="list-style-type: none"> • GHG emissions, land use and leachate formation associated with waste recovery and disposal 	<ul style="list-style-type: none"> • Pressure indicator, long term 	<ul style="list-style-type: none"> • Air emissions by disposal and recovery operations • Emissions of hazardous substances from waste recovery and disposal • Land use by landfill
3.d) Is the transportation of waste being minimized?	<ul style="list-style-type: none"> • 6EAP • Waste Management Strategy • Waste Framework Directive • Waste Shipments Regulation • Waste Incineration Directive 	<ul style="list-style-type: none"> • Total amount of waste transported (tonne km) 	<ul style="list-style-type: none"> • Driving force, long term 	<ul style="list-style-type: none"> • Share of waste transport in total freight transport • Transboundary waste transport (distinguishing waste for recovery and for disposal) • Total waste imported and exported (by main categories, country of origin and destination, distinguishing waste for recovery and for disposal) • Amount of shipped hazardous waste submitted to regulation

3e) Are the current and future (planned) waste management capacities sufficient?	<ul style="list-style-type: none"> • Waste Framework Directive • Hazardous Waste Directive 	<ul style="list-style-type: none"> • Actual and planned treatment capacity, ratio to total waste generation (including hazardous) 		<ul style="list-style-type: none"> • Indicators to be identified
3.f) What are the costs and benefits of waste management?	<ul style="list-style-type: none"> • 6EAP • Waste Management Strategy 	<ul style="list-style-type: none"> • Waste management costs per ton by treatment category (Euro) • Indicator measuring avoiding of environmental impacts from waste management (to be developed) 	<ul style="list-style-type: none"> • Response indicator, long term • Response indicator, long term 	<ul style="list-style-type: none"> • Employment in the waste management sector • Total capacity of the waste management sector and planned capacity related to GDP or turnover of the sector • Capital invested in waste management • Indicators characterizing management of specific waste streams e.g. cost of preventing a tonne of GHG in a biogas plant
3.g) Which policies have been implemented to manage waste more sustainable?	<ul style="list-style-type: none"> • 6EAP 	<ul style="list-style-type: none"> • Indicator to be defined 	<ul style="list-style-type: none"> • Response indicator, long term 	<ul style="list-style-type: none"> • Number of EU, national, and regional waste regulations/legislative acts and action programmes in force and implemented • R&D investments in the waste management sector • Number of applications of economic instruments and voluntary agreements addressing waste management