

Manual on the Basic Set of Environment Statistics of the FDES 2013



Generation and Management of Waste

(Topics 3.3.1 Generation of waste and 3.3.2 Management of waste
of the Basic Set of Environment Statistics of the FDES 2013)

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of the United Nations Statistics Division,
in collaboration with the
Expert Group on Environment Statistics*

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Methodology sheet of the Basic Set of Environment Statistics of the FDES

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1. Statistics in Topics 3.3.1 Generation of waste and 3.3.2 Management of waste

Component 3: Residuals¹			
Sub-component 3.3: Generation and Management of Waste			
Topic 3.3.1: Generation of waste			
Statistics and Related Information		Category of Measurement	Potential Aggregations and Scales
<i>(Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)</i>			Methodological Guidance
a.	Amount of waste generated by source	Mass	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ By households ▪ By tourists ▪ National ▪ Sub-national <ul style="list-style-type: none"> ▪ European Commission: European List of Waste, pursuant to European Waste Framework Directive ▪ Eurostat: Environmental Data Centre on Waste
b.	Amount of waste generated by waste category	Mass	<ul style="list-style-type: none"> ▪ By waste category (e.g., chemical waste, municipal waste, food waste, combustion waste) ▪ National ▪ Sub-national <ul style="list-style-type: none"> ▪ Eurostat: European Waste Classification for Statistics (EWC-Stat), version 4 (Waste categories) ▪ Basel Convention: Waste categories and hazardous characteristics
c.	Amount of hazardous waste generated	Mass	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national <ul style="list-style-type: none"> ▪ Eurostat: Manual on Waste Statistics ▪ Eurostat: Guidance on classification of waste according to EWC-Stat categories ▪ SEEA Central Framework (2012) ▪ UNSD: Environment Statistics Section-Waste Questionnaire

¹ United Nations Statistics Division (2017) *Framework for the Development of Environment Statistics (FDES 2013)*, <https://unstats.un.org/unsd/environment/fdes/FDES-2015-supporting-tools/FDES.pdf> (accessed 16 October 2018)

Topic 3.3.2: Management of waste			
a.	Municipal waste		<ul style="list-style-type: none"> ▪ By type of treatment and disposal (e.g., reuse, recycling, composting, incineration, landfilling, other) ▪ By type of waste, when possible ▪ National ▪ Sub-national
	1. Total municipal waste collected	Mass	
	2. Amount of municipal waste treated by type of treatment and disposal	Mass	
	3. Number of municipal waste treatment and disposal facilities	Number	
	4. Capacity of municipal waste treatment and disposal facilities	Volume	
b.	Hazardous waste		
	1. Total hazardous waste collected	Mass	
	2. Amount of hazardous waste treated by type of treatment and disposal	Mass	
	3. Number of hazardous waste treatment and disposal facilities	Number	
	4. Capacity of hazardous waste treatment and disposal facilities	Volume	
c.	Other/industrial waste		
	1. Total other/industrial waste collected	Mass	
	2. Amount of other/industrial waste treated by type of treatment and disposal	Mass	
	3. Number of other/industrial waste treatment and disposal facilities	Number	
	4. Capacity of other/industrial waste treatment and disposal facilities	Volume	
d.	Amount of recycled waste	Mass		▪ By specific waste streams (e.g., e-waste, packaging waste, end-of-life vehicles) ▪ By waste category ▪ National ▪ Sub-national
e.	Imports of waste	Mass	<ul style="list-style-type: none"> ▪ By waste category (e.g., chemical waste, municipal waste, combustion waste)
f.	Exports of waste	Mass	
g.	Imports of hazardous waste	Mass	
h.	Exports of hazardous waste	Mass	

2. Introduction/Relevance

2A. Waste issues

Environment statistics on waste, comprising waste generation and waste management, provide important information to policymakers to support the protection of the environment. Understanding the quantity and characteristics of waste generated and whether the waste is hazardous or not, is required to plan for present and future waste management, in terms of transportation and numbers and capacity of treatment facilities required.² Waste management policies are needed to develop and maintain collection systems and to ensure effective treatment and disposal. Poor control of waste causes air pollution, water and soil contamination; increasing volumes of hazardous waste, such as electrical and electronic waste, and other wastes such as plastics, present increasing challenges for waste management with negative effects on health and the environment.

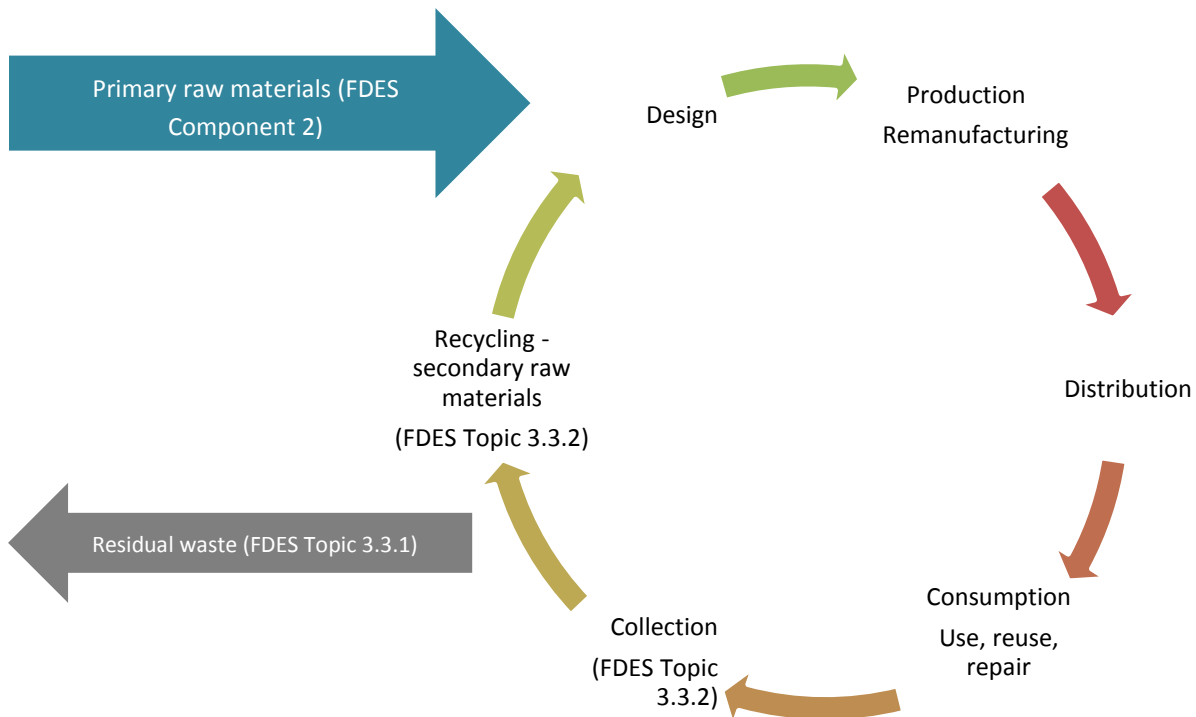
Waste management policies, particularly in developed countries, are moving towards approaches which are integrated with the economy and which focus on prevention and minimisation of waste. These can be positioned under the concept of the circular economy (see figure 2.1) which is a shift in the concept of economic production which aims to preserve and enhance natural capital, optimise resource yields and better manage resource stocks and renewable flows. Under this concept waste is considered not only as the end of the production and consumption chain but as a resource which feeds back into the economy, such as when recycled or used as a fuel source.

The Framework for the Development of Environment Statistics (FDES 2013) recognizes the necessity to consider waste in the circular economy, as reducing the amount of waste generated and increasing the share of waste that is recycled and reused as material or energy source, is central to sustainable consumption and production and natural resource management. The final disposal of waste in the environment, even if in a controlled manner, creates pollution and occupies considerable land area.³

² United Nations Statistics Division (2017) *Framework for the Development of Environment Statistics (FDES 2013)*, <https://unstats.un.org/unsd/environment/fdes/FDES-2015-supporting-tools/FDES.pdf> (accessed 16 October 2018)

³ United Nations Statistics Division (2017) *Framework for the Development of Environment Statistics (FDES 2013)*, <https://unstats.un.org/unsd/environment/fdes/FDES-2015-supporting-tools/FDES.pdf> (accessed 14 October 2018)

Figure 2.1: Circular economy



Waste generated can pose problems to human health and the environment, at local, national, regional and global scales, such as contributions to greenhouse gas emissions and pollution of oceans by plastics. Volumes of waste continue to increase in high income countries, and processes of urbanization, increased population growth and economic development suggests that waste generation will rise in low- and middle-income countries.⁴ Without adequate waste regulations, which are implemented and enforced, waste may be dumped into the environment with significant consequences for public health and environmental pollution.⁵ In addition, safe management of specific waste streams, such as e-waste, packaging (including plastic bags and other plastics) and food waste are increasing issues globally. Development of waste management systems remains crucial in addressing the negative impacts of waste.

In addition, it is also necessary to understand how waste can be used as a resource in the circular economy. The waste management hierarchy is a concept of waste management which incorporates practices relevant to the circular economy. The waste management hierarchy, shown in figure 2.2., is widely applied in many countries, particularly in developed countries. It is used to frame waste management options and is part of waste legislation in some cases, such as the European Union (EU). The waste hierarchy ranks waste and materials management options, i.e., prevention, minimisation, reuse (including remanufacturing), recycling, energy recovery and disposal. In the hierarchy, prevention is most preferred with disposal as least preferred. The preference is based on the option's environmental impact and material resource consumption, and its ability to foster an efficient use of resources.

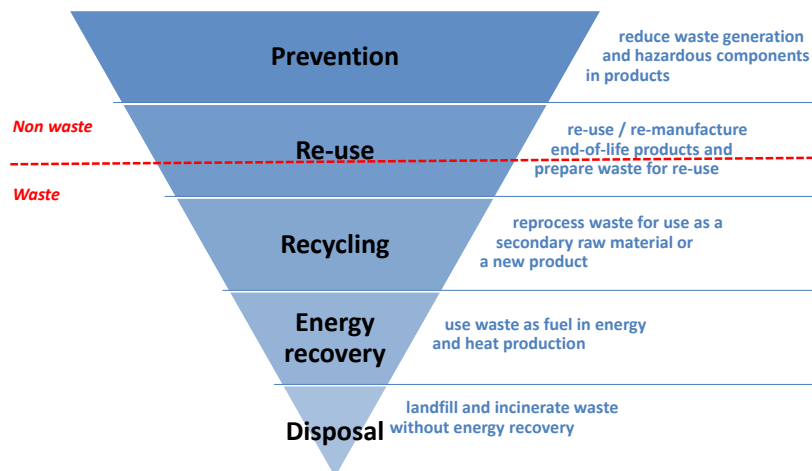
⁴ United Nations Environment Programme (2015) *Global Waste Management Outlook*, <http://web.unep.org/ourplanet/september-2015/unep-publications/global-waste-management-outlook> (accessed 14 October 2018)

⁵ United Nations Environment Programme (2015) *Global Waste Management Outlook*, <http://web.unep.org/ourplanet/september-2015/unep-publications/global-waste-management-outlook> (accessed 14 October 2018)

Waste prevention refers to the reduction at source of the amounts of waste generated and of the hazardous components embodied in waste and products. It is encouraged through eco-design, reuse, repair, refurbishment, re-manufacturing, and extended producer responsibility (EPR) schemes.

In low- to middle-income countries, it is important to recognize that many settlements are at the point of entering onto the hierarchy, by moving from uncontrolled disposal, including open dumping and burning, to controlled disposal methods, such as controlled landfill and incineration; and by expanding collection to the entire population, including rural areas, which currently often lack service.⁶

Figure 2.2: The waste management hierarchy



Source: OECD based on various other sources.

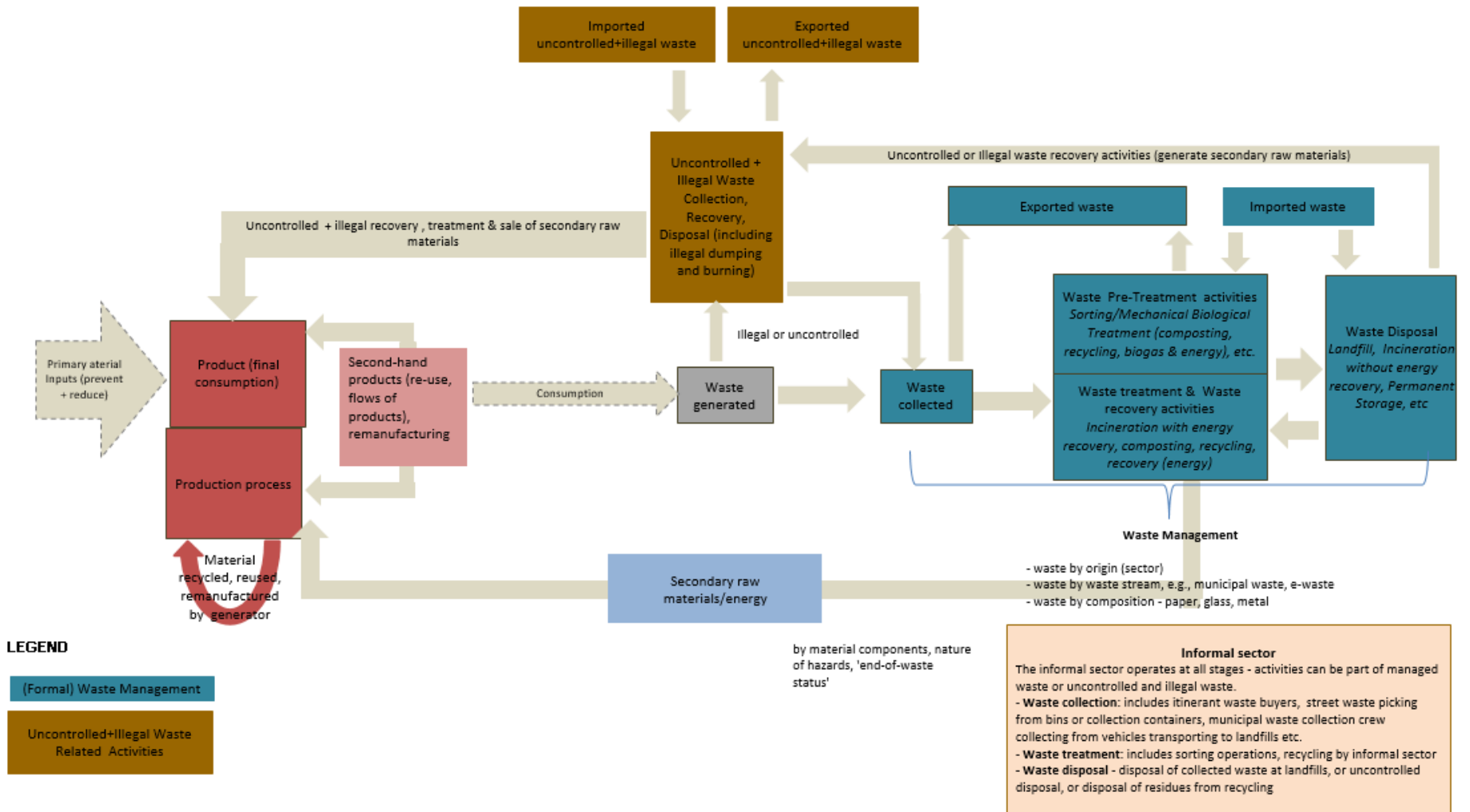
The challenge waste presents to achieving sustainable development is recognized in the Sustainable Development Goals in Goal 11: Sustainable Cities and Communities and Goal 12: Responsible Production and Consumption which address the impact of waste on cities from rapid urbanization and the impact on the environment from increased material consumption and increased resource use.

2B. Flows of waste

As shown in figure 2.3, waste prevention starts with the reduced use of material resources in the production process. Once goods are consumed second-hand and remanufactured products can re-enter consumption streams or production processes. Material may also be re-used or recycled by producers directly in production processes. As goods are produced and consumed waste is generated, in which case it may be collected, treated, disposed, recovered or exported/imported either through waste management or illegal and uncontrolled activities. Waste may be exported for treatment and disposal rather than treated or disposed of in the country, and waste may be imported for treatment and disposal. Recovered waste provides secondary raw materials which flow back to production. Interaction between the (formal) waste management and uncontrolled and illegal waste activities can occur for example, with waste recovery from municipal disposal sites by uncontrolled waste pickers, which then re-enters the production processes.

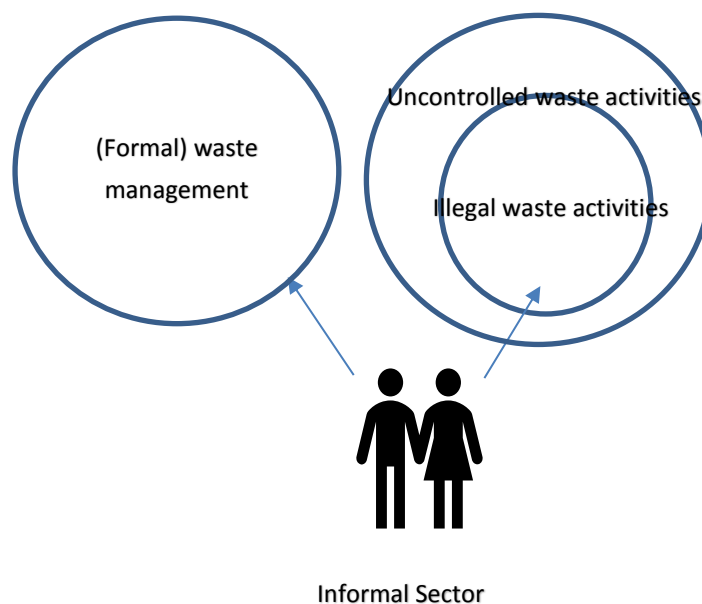
⁶ United Nations Environment Programme (2015) *Global Waste Management Outlook*, <http://web.unep.org/ourplanet/september-2015/unep-publications/global-waste-management-outlook> (accessed 14 October 2018)

Figure 2.3: Flows of waste



2C. Actors in waste management and waste activities

Figure 2.4: Relationship between waste management, uncontrolled and illegal waste, and the informal sector



Waste can be managed through (formal) waste management or remain uncontrolled waste as shown in figure 2.4. Illegal waste can be considered a subset of uncontrolled waste depending on the laws of the country. The informal sector is an actor, which can operate with either of (formal) waste management, or uncontrolled and illegal waste activities depending on its level of integration into (formal) waste management systems. The characteristics of the informal waste sector are specific to each country, and no internationally agreed upon definition exists. The International Labour Organization defines the term “informal economy” as referring to all economic activities by workers and economic units that are – in law or in practice – not covered or insufficiently covered by formal arrangements.⁷ It should be noted that the informal sector is an umbrella term which refers to a wide range of activities from totally uncontrolled and poorly organized activities which are not taxed, to fully organized, controlled legalized tax paying activities which have been integrated into the economy and waste management.

2D. Waste statistics issues

Issues of waste statistics arise both in the production of internationally comparable statistics and in the production of statistics at the national level. The production of internationally comparable statistics on waste generation and management is challenging – partly due to the diversity of waste management systems in countries which leads to difficulties in collection of data according to international concepts, definitions and classifications. As a result, data on waste are difficult to compare internationally. In some cases, there is a need for further development of the international concepts, definitions and classifications; but in other instances, it is the varying nature of waste systems in countries which creates difficulty in collecting data according to standard concepts and definitions. This methodology sheet does not attempt to reconcile these issues but highlights some of the challenges which may occur when compiling and interpreting waste statistics.

⁷ ILO, *Informal Economy* webpage, <https://www.ilo.org/global/topics/employment-promotion/informal-economy/lang--en/index.htm> (accessed 19 October 2018)

Statistics on waste generated are usually estimated; at the national level the absence of strict national regulations on waste or monetary transfers connected to the removal of waste, result in waste which is not recorded by the generator. Therefore, data collected directly on waste generated tends to focus on special waste streams which are important and may be regulated, rather than on all waste generated.

Waste management services are often provided more frequently in urban than rural areas, particularly in low- and middle-income countries. Data on waste management may therefore refer to national level data but may cover only urban areas or selected major cities, even though reference is made to the national level. Other issues relate to circumvention of the waste management regulations through illegal or uncontrolled dumping or burning, or unlicensed waste operations such as scrap yards or waste dumps, which may take the form of fly tipping or stockpiling on rented or public land. Its very nature makes detection difficult and statistics rely largely on monitoring and enforcement activities, voluntary reporting and surveillance of known sites.

Waste collection and management are carried out by several players: municipal government, informal sector and private sector waste management. Data are more often available for the government sector, rather than on the informal and private sector. Data may be available for private sector operators and the informal sector who are sub-contracted to the municipal government as these collection activities are well monitored, and disposal is at municipally controlled sites.⁸ For international data reporting, data are only included when collected by or on behalf of municipal authorities thus collected as part of (formal) waste management.

Other issues for waste generation and management are data on imports and exports of waste. Imports and exports are often materials for recycling which may be recorded under the customs code for the material rather than specifically as waste, e.g., computers. This can create challenges in identifying what is waste or secondary material as it may be recorded as the original product not as waste. In addition, illegal imports and exports of waste are increasingly problematic. This trade is particularly related to hazardous wastes, as well as waste with a high value for recyclers such as e-waste, scrap metals and textiles. Illegal trade in waste often circumvents strict environmental laws or taxes on waste in the exporting countries and presents a high risk of environmental damage to receiving countries.

Data on waste collection and other activities by the informal sector are particularly relevant to understanding the economic value of waste through material recovery, such as recycling, and energy recovery, e.g., where informal sector waste pickers are the major collectors of recycled materials such as glass, paper and cardboard, metals and plastics. Data incorporated into official statistics varies by the level of integration of the informal sector into waste management, as in some countries waste pickers are organized into recyclers' organizations and may be integrated into (formal) waste management, while in others waste pickers operate independently with sales of materials to waste buyers/middle men.

In addition to mixed waste, specific waste streams are increasingly of high policy interest such as food waste, waste electrical and electronic equipment (WEEE) and end-of-life vehicles (ELV) (including tyre wastes) or require special management, such as medical waste, and construction and demolition waste that has a large volume and is difficult to dispose of, and/or contain hazardous materials, such as asbestos. For some areas such as food waste and WEEE statistical methodologies are in development, while for others such as construction and demolition or medical wastes, the availability of data varies depending on the need for monitoring and policy formulation.

⁸ United Nations Environment Programme (2015) *Global Waste Management Outlook*, <http://web.unep.org/ourplanet/september-2015/unep-publications/global-waste-management-outlook> (accessed 14 October 2018)

2E. Structure of the methodology sheet

This methodology sheet covers Topic 3.3.1: Generation of waste and Topic 3.3.2: Management of waste. Wastewater is excluded as it is described under Sub-component 3.2: Generation and Management of Wastewater. Topic 3.3.1 describes the waste generated, which refers to the amount and type of waste produced by economic activities and by households, before any collection or treatment and disposal of waste. Topic 3.3.2 describes the management of waste, which includes the collection and treatment of waste, including recycling, recovery and reuse as well as final disposal, and the available capacities for waste treatment.

This methodology sheet refers to definitions used in international statistical frameworks and data collections on waste, namely the United Nations Statistics Division/United Nations Environment Programme (UNSD/UNEP) Questionnaire 2018 on Environment Statistics;⁹ the Joint OECD/Eurostat Questionnaire on the State of the Environment (OECD/Eurostat);¹⁰ the EU Directive 2008/98/EC¹¹ on waste amended by Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste;¹² the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel);¹³ and the System of Environmental-Economic Accounting Central Framework (SEEA).¹⁴

It should be noted that this methodology sheet is harmonized with the ongoing work of the Task Force on Waste Statistics convened by the United Nations Economic Commission for Europe (ECE) in October 2016 to develop a conceptual framework on waste statistics and draft a glossary of the most important terms and definitions in waste statistics in relation to the ECE region. The Task Force is addressing waste statistics in its broader context linking waste to the economy, patterns of consumption and the environment. The definitions included in this methodology sheet have been discussed in the work of the Task Force.

It should be noted that as of 2002 with the introduction of the EU Waste Framework Directive, waste data for EU countries are collected under the EU regulation on waste statistics not the OECD/Eurostat Questionnaire (first statistics reference year 2004). EU countries use the OECD/Eurostat Questionnaire only for municipal waste.

The methodology sheet has separated the sections on concepts and definitions. Section 3 Concepts in waste statistics covers the concepts relevant to the statistics in the FDES, namely, waste, waste composition, waste streams, waste treatment and disposal, imports and exports and hazardous waste, many of which are pertinent to more than one statistic. Section 4 Definitions and description of the statistics provides definitions for the specific statistics in the Basic Set of Environment Statistics. As there are often several internationally used definitions, the one most relevant to the broadest range of countries is suggested, while others are listed.

⁹ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, <https://unstats.un.org/unsd/envstats/questionnaire> (accessed 14 October 2018)

¹⁰ OECD/Eurostat (2014) *Joint OECD/Eurostat Questionnaire on the State of the Environment*, Paris

¹¹ European Union (2008) *Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives*, <http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32008L0098> (accessed 15 October 2018)

¹² European Union (2015) *Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste*, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018L0851> (accessed 17 October 2018)

¹³ Basel Convention and United Nations Environment Programme (1989) *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, <http://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf> (accessed 18 October 2018)

¹⁴ United Nations, European Commission, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank (2014) *System of Environmental-Economic Accounting 2012: Central Framework*, Studies in Methods, Series F, No. 109. Sales No. E.12.XVII.12, https://seea.un.org/sites/seea.un.org/files/seea_cf_final_en.pdf (accessed 17 October 2018)

3. Concepts in waste statistics

3A. Waste

Waste is defined in the UNSD/UNEP Questionnaire 2018 on Environment Statistics¹⁵ as “Materials that are not prime products (i.e., products produced for the market) for which the generator has no further use for his own purpose of production, transformation or consumption, and which he discards, or intends or is required to discard. It excludes material directly recycled or reused at the place of generation (i.e., establishment) and waste materials that are directly discharged into ambient water or air as wastewater or air pollution.”

Other definitions

The Joint OECD/Eurostat Questionnaire on the State of the Environment^{16 17} defines waste similarly but provides further definition of primary and secondary waste. Waste is defined as “Waste refer here to materials that are not prime products (i.e., products produced for the market) for which the generator has no further use for own purpose of production, transformation or consumption, and which he discards, or intends or is required to discard. Wastes may be generated during the extraction of raw materials during the processing of raw materials to intermediate and final products, during the consumption of final products, and during any other human activity. Are excluded: residuals directly recycled or reused at the place of generation (i.e., establishment); waste materials that are directly discharged into ambient water or air.”

The Joint OECD/Eurostat Questionnaire also provides definitions of primary and secondary waste. Primary waste is defined as “Waste from primary sources, i.e., waste generated during the extraction of raw materials during the processing of raw materials to intermediate and final products, during the consumption of final products, and during a cleaning operation.” Secondary waste (treatment residues) is defined as “Waste from secondary sources, i.e., waste generated in a process that is known as a waste treatment operation. Includes residual materials originating from recovery and disposal operations, such as incineration and composting residues. ... In accordance with the definition of waste ... waste from sewage treatment (i.e., sewage sludge) is considered as primary waste.”

Waste can be aggregated by waste streams, composition of waste, sources of waste, or waste treatment and disposal methods which are discussed in sections 3B to 3E.¹⁸ Waste statistics are often produced for municipal and hazardous waste because of their importance.

¹⁵ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

¹⁶ OECD/Eurostat (2014) *Joint OECD/Eurostat Questionnaire on the State of the Environment*, Paris

¹⁷ All definitions from the *Joint OECD/Eurostat Questionnaire on the State of the Environment* are included in Eurostat (2010) *Manual on Waste Statistics*, Luxembourg, Eurostat, <http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-RA-13-015> (accessed 15 October 2018)

¹⁸ UNECE (2016) *Problems with Waste Statistics and a Proposal for Action*, Conference of European Statisticians, Meeting of the 2016/2017 Bureau, Ottawa, 11-12 October 2016. Item 3 (d). ECE/CES/BUR/2016/OCT/7, http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/bur/2016/October/07-Waste_statistics_final.pdf (accessed 14 October 2018)

3B. Waste stream

A waste stream describes the life cycle of waste from its source to end through recovery, recycling or disposal. These waste streams may be linked to specific sources (e.g., hospitals) and types of waste (e.g., medical waste).¹⁹ This may be used to aggregate statistics on waste generated or statistics on waste treated and disposed of. Often statistics are collected for specific waste streams, with detailed statistics collected for waste streams of importance to policy.

The waste streams used in the Joint OECD/Eurostat Questionnaire on the State of the Environment:²⁰

- Construction/demolition wastes (not the same as waste from the construction sector), including excavated soils, e.g., rubble and other waste material arising from the construction, demolition, renovation or reconstruction of buildings or parts thereof, whether on the surface or underground. Consists mainly of building material and soil. Includes waste from all origins and all economic sectors
- Dredged spoils
- Sewage sludges
- Excess manure
- End-of-life vehicles
- Used tyres
- Electric and electronic scrap, e.g., refrigerators, washing machines, televisions, audio apparatus, computers, small electric and electronic household appliances (i.e., WEEE)
- Food waste
- Mineral and synthetic oils
- Other waste, e.g., waste arising from air pollution control measures, medical waste, disposable baby nappies, batteries and accumulators, ceramics, organic waste, etc.

3C. Composition of waste

The UNSD/UNEP Questionnaire 2018 on Environment Statistics refers to composition of waste, i.e., the material content of the waste. This is often applied to municipal waste. There is also often interest in the hazardous component of municipal waste, although data may be difficult to obtain.

Municipal waste composition²¹

- Paper, paperboard
- Textiles
- Plastics
- Glass
- Metals
- Other inorganic materials
- Organic material *of which*
 - Food and garden waste

¹⁹ UNECE (2016) *Problems with Waste Statistics and a Proposal for Action*, Conference of European Statisticians, Meeting of the 2016/2017 Bureau, Ottawa, 11-12 October 2016. Item 3 (d). ECE/CES/BUR/2016/OCT/7, http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/bur/2016/October/07-Waste_statistics_final.pdf (accessed 14 October 2018)

²⁰ OECD/Eurostat (2014) *Joint OECD/Eurostat Questionnaire on the State of the Environment*, Paris

²¹ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

However, countries may also collect additional categories, e.g., in Tanzania data are collected on kitchen waste, grass and wood, ceramic and stone, leather and rubber.

Other definitions:

The Joint OECD/Eurostat Questionnaire on the State of the Environment²² refers to the following composition of municipal waste.

- Paper, paperboard, paper products
- Textiles
- Plastics
- Glass
- Metals
- Organic material
 - of which: food waste
 - of which: garden waste
- Other waste

3D. Sources of waste

Waste is also aggregated by source, i.e., the economic activity (classified by ISIC) and households that generated the waste. This is usually applied to statistics on waste generated. The UNSD/UNEP Questionnaire 2018 on Environment Statistics refers to:

- Agriculture, forestry and fishing (ISIC 01-03)
- Mining and quarrying (ISIC 05-09)
- Manufacturing (ISIC 10-33)
- Electricity, gas, steam and air conditioning supply (ISIC 35)
- Construction (ISIC 41-43)
- Other economic activities excluding ISIC 38
- Households

3E. Waste treatment and disposal

Waste treatment and disposal methods apply to statistics on waste treated and disposed of. The UNSD/UNEP Questionnaire 2018 on Environment Statistics refers to:²³

- Recycling is defined as any reprocessing of waste material in a production process that diverts it from the waste stream, except reuse as fuel. Both reprocessing as the same type of product, and for different purposes should be included. Recycling within industrial plants i.e., at the place of generation should be excluded.
- Composting refers to a biological process that submits biodegradable waste to anaerobic (biomethanization) or aerobic decomposition, and that results in a product that is recovered and can be used to increase soil fertility (products are compost and biogas).
- Incineration consists in the controlled combustion of waste with or without energy recovery. Energy recovery means that evolving thermal energy is used for the production of steam, hot water or electric energy.

²² OECD/Eurostat (2014) *Joint OECD/Eurostat Questionnaire on the State of the Environment*, Paris

²³ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

- Landfilling is defined as the final placement of waste into or onto the land in a controlled or uncontrolled way. The definition covers both landfilling in internal sites (i.e., where a generator of waste is carrying out its own waste disposal at the place of generation) and in external sites.
- Other (waste treatment/disposal for hazardous waste) means any final treatment or disposal different from recycling, incineration and landfilling. Examples include physical/chemical treatment, biological treatment, releasing of waste into water bodies and permanent storage.

Remarks:

- Statistics on waste generated and waste treated are not always coherent as waste generated in one year may not be treated in the same year.
- Statistics on waste treatment do not include pre-treatment activities (like sorting, drying, mechanical biological treatment (MBT)), but only the final treatment or disposal.²⁴ However, for countries with complex waste treatment systems, statistics on pre-treatment are increasingly important for understanding waste management, e.g., in the European Union the EU Landfill Directive (1999/31/EC) oblige landfill operators of Member States to show that all waste accepted at landfill has been pre-treated. Omitting these or not identifying which are pre-treatment does not fully capture the flows of waste which are important for some countries. International data collections, such as the UNSD/UNEP Questionnaire, have tended to focus on final treatments or disposal given the availability of data and the current treatments available in most countries.
- Specific guidance for reporting on waste which is pre-treated (in operations such as sorting or MBT²⁵ is provided by Eurostat.²⁶ The pre-treated waste should be reported under the main waste treatment and disposal methods. For example, waste which undergoes MBT results in outputs suitable for recycling and composting, with other residues for incineration and landfill. The total amount treated under MBT should therefore be disaggregated and quantities reported according to the final four treatments of the MBT outputs (recycling and composting, with other residues for incineration and landfill).
- There is the potential for double counting of secondary waste, which is the re-treatment or disposal of the final waste treatment from MBT or sorting operations, e.g., residues of incineration which are landfilled or residues from composting which are incinerated. Current practices recommend that secondary wastes should not be included.
- Under the Eurostat guidance biological treatment of mixed waste is not counted as composting due to unacceptable levels of contamination, except where there is proof that it is used for land or biological treatment. Only separately collected organic materials are reported as composting.
- In some definitions, the term disposal is not used and the term municipal waste treatment is used which includes pre-treatment (e.g., MBT or sorting) and final treatment (e.g., incineration, landfill, composting and

²⁴ Eurostat (2016) *Guidance on municipal waste data collection*, May 2017, <http://ec.europa.eu/eurostat/documents/342366/351811/Municipal+Waste+guidance/bd38a449-7d30-44b6-a39f-8a20a9e67af2> (accessed 18 October 2018)

²⁵ MBT is a generic term that refers to the grouping of several pre-treatment processes. It encompasses mechanical and biological pre-treatment, including mechanical sorting, composting or anaerobic digestion, prior to specific recovery and disposal operations.

²⁶ Eurostat (2016) *Guidance on municipal waste data collection*, May 2017, <http://ec.europa.eu/eurostat/documents/342366/351811/Municipal+Waste+guidance/bd38a449-7d30-44b6-a39f-8a20a9e67af2> (accessed 18 October 2018)

recycling) which covers disposal and recovery.²⁷ In other cases the term treatment is used for recovery, recycling and reuse and disposal or treatment and disposal for other operations, e.g., landfill, incineration.²⁸

Other definitions

Other international collections provide definitions harmonized with the UNSD/UNEP Questionnaire, although additional terms are provided for recovery and re-use, processes related to options at the top of the waste hierarchy.

Joint OECD/Eurostat Questionnaire on the State of the Environment²⁹

The Questionnaire provides a more detailed description of recovery operations, with a distinction between recovery and re-use of waste. It also gives details of types of treatment and disposal, and a detailed description of the disposal methods. For non-hazardous waste the following groupings are used:

- Recovery is defined as any waste management operation that diverts a waste material from the waste stream and which results in a certain product with a potential economic or ecological benefit. Recovery mainly refers to the following operations:
 - material recovery (i.e., recycling (same definition as UNSD/UNEP));
 - biological recovery (e.g., composting (same definition as UNSD/UNEP), biomethanisation for production of biogas);
 - Incineration with energy recovery (same definition as UNSD/UNEP);

Note: Incineration with energy recovery is considered a recovery operation and incineration without energy recovery is considered a disposal operation.³⁰

- Re-use means any operation by which end-of-life products and equipment (e.g., electrical and electronic equipment) or its components are used for the same purpose for which they were conceived. Direct recycling or reuse within industrial plants at the place of generation and on-site composting are excluded because the materials do not enter the waste stream.
- Disposal is defined as any waste management operation serving or carrying out the final treatment and disposal of waste. It covers the following main operations:
 - Final treatment: Incineration without energy recovery (on land; at sea) (same definition as UNSD/UNEP); biological, physical, chemical treatment resulting in products or residues that are discarded, i.e., going to final disposal.
 - Final disposal: Landfill is here defined as deposit of waste into or onto land, including specially engineered landfill, and temporary storage of over one year on permanent sites. The definition covers both landfill in internal sites (i.e., where a generator of waste is carrying out its own waste disposal at the place of generation) and in external sites. Other methods of final disposal are deep injection, surface impoundment, release into water bodies and permanent storage.

²⁷ Eurostat (2016) *Guidance on municipal waste data collection*, May 2017,

<http://ec.europa.eu/eurostat/documents/342366/351811/Municipal+Waste+guidance/bd38a449-7d30-44b6-a39f-8a20a9e67af2> (accessed 18 October 2018)

²⁸ OECD/Eurostat (2014) *Joint OECD/Eurostat Questionnaire on the State of the Environment*, Paris

²⁹ OECD/Eurostat (2014) *Joint OECD/Eurostat Questionnaire on the State of the Environment*, Paris

³⁰ OECD/Eurostat (2014) *Joint OECD/Eurostat Questionnaire on the State of the Environment*, Paris

- Controlled landfill is a subset of landfill and is defined as landfill whose operation is submitted to a permit system and to technical control procedures in compliance with the national legislation in force. Includes specially engineered landfill (e.g., placement into lined discrete cells which are capped and isolated from one another and the environment).

For hazardous waste the groupings are:

- Recovery operations
 - Incineration with energy recovery
 - Recycling, composting etc.
 - Other recovery operations

- Disposal operations
 - Physico/chemical treatment
 - Biological treatment
 - Incineration without energy recovery (thermal treatment)
 - Landfill and other deposit into or onto land
 - Release into water bodies
 - Permanent storage

European Union

Concepts on waste are guided by the EU Directive 2008/98/EC 2008³¹ and the amending Directive 2008/98/EC.³² These cover the generation and management of waste and set out a list of treatment and disposal operations in Annex I (Disposal operations) and Annex II (Recovery operations).³³ Key concepts are:

- Waste management: the collection, transport, recovery (including sorting), and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker.
- Recovery of waste: any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.
- Reuse of waste: any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.
- Preparing for re-use: checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.
- Recycling of waste: any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

³¹ European Union (2008) *Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives*, <http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32008L0098> (accessed 15 October 2018)

³² European Union (2015) *Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste*, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018L0851> (accessed 17 October 2018)

³³ European Union (2008) *Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives*, <http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32008L0098> (accessed 15 October 2018)

4. Definitions and description of the statistics

4A. Generation of waste (Topic 3.3.1)

Amount of waste generated by source (FDES 3.3.1.a)

The amount of waste (measured by weight) that is generated before collection or treatment, by source. Source refers to the economic activities (according to the International Standard Industrial Classification of All Economic Activities – ISIC Rev. 4)³⁴ and households that generated the waste.

Remarks:

- When comparing data between countries mineral wastes are frequently considered separately as in many countries these wastes, stemming from construction and demolition and from mining activities, are often more than 60% of the waste which creates difficulty when comparing with countries which do not produce high volumes of mineral waste.
- Waste generated is not always collected by waste collection services, and it may be treated or disposed of by the economic units or households. Therefore, the amount of generated waste is often larger than the amount of formally collected waste. Using statistics on waste collection to estimate generation may therefore underestimate the total amount generated particularly when the waste collection serves only a small proportion of the population and/or economic activities.
- When waste statistics are aggregated by source (ISIC divisions), waste from “*ISIC 38 Waste collection, treatment and disposal activities; materials recovery*” is usually excluded to avoid double counting.

Amount of waste generated by waste category (FDES 3.3.1.b)

The amount of waste (measured by weight) that is generated before any collection or treatment is applied.

Refer to Sections 3B to 3D for detail on how waste generated can be aggregated.

Remarks:

- Waste streams are not mutually exclusive therefore it is not possible to add waste generated between streams as this would result in double counting.
- Waste generated in waste management facilities, if included, would result in double counting if waste is also calculated from other categories.

Amount of hazardous waste generated (FDES 3.3.1.c)

The amount of hazardous waste (measured by weight) generated before any collection or treatment is applied.

³⁴ United Nations Statistics Division (2008) *International Standard Industrial Classification of All Economic Activities, Rev. 4*, <http://unstats.un.org/unsd/cr/registry/isic-4.asp> (accessed 18 October 2018)

Remarks:

- Statistics can be broken down by hazardous waste type and economic activity generating the waste. It is important to cover all economic activities as hazardous waste comes from all sectors.
- Household hazardous waste, such as batteries, pesticides, paints etc., may be underestimated as these are often collected in mixed municipal waste.
- Low-level radioactive waste (e.g., contaminated hospital waste such as clothing, cleaning materials etc., carcasses of animals treated with radioactive materials used in research, laboratory equipment where radioactive materials are used) is included, whereas other radioactive waste is excluded (e.g., waste from nuclear reactors).

4B. Management of waste (Topic 3.3.2)

The Framework for the Development of Environment Statistics (FDES 2013) identifies statistics for management of waste broken down into municipal waste, hazardous waste and other/industrial waste. These terms identify wastes which are collected and treated together, therefore statistical data collection can be targeted to the establishments engaged in their collection, treatment and disposal.

In some countries, such as in Europe, waste management is becoming more complex. The greater number of pre-treatment steps make it difficult to follow waste through the waste treatment system, which creates difficulties for statistics describing the flow of waste and in understanding waste management options in a more circular economy. This complexity creates difficulties in linking waste generated, waste collected, treated and disposed. In addition, statistics specific to understanding the generation of resources from waste are needed for informing the circular economy.

4B.1 Management of waste: Municipal waste (Topic 3.3.2.a)³⁵

Municipal waste is defined in the UNSD/UNEP Questionnaire 2018 on Environment Statistics as:

Municipal waste, collected by or on behalf of municipalities, by public or private enterprises, includes waste originating from: households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). It also includes bulky waste (e.g., white goods, old furniture, mattresses) and waste from selected municipal services, e.g., waste from park and garden maintenance, waste from street cleaning services (street sweepings, the content of litter containers, market cleansing waste), if managed as waste. The definition excludes waste from municipal sewage network and treatment, municipal construction and demolition waste.

Remark:

- Private enterprises may include operators in the informal sector. Under the definition these are included if collection is on behalf of municipalities.

Other definitions are provided for comparison. Note that the definitions of municipal waste used by the international statistical system are harmonized.

³⁵ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

Joint OECD/Eurostat Questionnaire on the State of the Environment³⁶

Municipal waste includes household waste and similar waste.

The definition also includes:

- bulky waste (e.g., white goods, old furniture, mattresses); and
- yard waste, leaves, grass clippings, street sweepings, the content of litter containers, and market cleansing waste, if managed as waste.

It includes waste originating from:

- households,
- commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings).

It also includes:

- waste from selected municipal services, i.e., waste from park and garden maintenance, waste from street cleaning services (street sweepings, the content of litter containers, market cleansing waste) if managed as waste.

It includes waste from these sources collected:

- door-to-door through traditional collection (mixed household waste), and
- fractions collected separately for recovery operations (through door-to-door collection and/or through voluntary deposits).

For the purpose of the questionnaire, municipal waste refers to waste defined as above, collected by or on behalf of municipalities.

The definition also includes waste from the same sources and similar in nature and composition which:

- are collected directly by the private sector (business or private non-profit institutions) not on behalf of municipalities (mainly separate collection for recovery purposes),
- originate from rural areas not served by a regular waste service, even if they are disposed of by the generator.

Household-like waste generated by sectors not covered by the definition of municipal waste (is not reported under municipal waste but under the relevant sector).

The definition excludes:

- waste from municipal sewage network and treatment,
- municipal construction and demolition waste.

Municipal Waste: Eurostat³⁷

“Municipal waste” means:

(a) mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture;

(b) mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households;

Municipal waste does not include waste from production, agriculture, forestry, fishing, septic tanks and sewage network and treatment, including sewage sludge, end-of-life vehicles or construction and demolition waste.

³⁶ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

³⁷ European Union (2015) *Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste*, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018L0851> (accessed 17 October 2018)

(Management of) Municipal waste (FDES 3.3.2.a)

Total municipal waste collected (FDES 3.3.2.a.1)

The amount of waste (measured by weight) collected by or on behalf of municipalities or other local authorities, by public or private enterprises.

Remarks:

- It is important to note that “municipal waste” is a group of wastes from different sources, whose characteristics are similar to household waste, and therefore waste from these sources can be collected and treated together.
- In some countries, a significant amount of waste may be collected by the informal sector rather than municipal collections. However, for international reporting the appropriate definition of municipal waste should be followed which covers municipal waste collected by or on behalf of municipalities.
- Important indicators for the status of waste management, such as collection coverage or share of collected to generated waste also require statistics on municipal waste generated as well as municipal waste collected.

Amount of municipal waste treated by type of treatment and disposal (FDES 3.3.2.a.2)

The amount of waste treated (measured by weight). It should be broken down into waste treatment types, such as those of the UNSD/UNEP Questionnaire 2018 on Environment Statistics: recycling, composting (with and without anaerobic fermentation), incineration (with or without energy recovery), landfilling (controlled or not) and other. See Section 3E for detail.

Number of municipal waste treatment and disposal facilities (FDES 3.3.2.a.3)

The number of waste treatment and disposal facilities by type of facility. Types of treatment include incineration (with- or without energy recovery), landfilling (controlled or not), composting, recycling and other facilities.

Remarks:

- There is no clear definition of municipal waste treatment facilities, as these may include facilities operated by municipalities but treating non-municipal waste, or facilities treating municipal waste only, or facilities operated by the private sector but treating both municipal or non-municipal waste. There may also be separate facilities solely for pre-treatment, e.g., MBT plants.
- Due to the difficulty of identifying facilities solely for municipal waste treatment, facilities for hazardous waste should be indicated.
- Landfills can be broken down by landfill type (landfills for hazardous, non-hazardous and inert waste) where data are available.
- Where pre-treatment of waste is important data should also be collected on pre-treatment facilities.

Capacity of municipal waste treatment and disposal facilities (FDES 3.3.2.a.4)

The capacities of waste treatment and disposal facilities should be specified by capacity of facility, disaggregated by type of treatment. Types of treatment include incineration (with- or without energy recovery), landfilling (controlled or not), composting, recycling and other facilities. Capacity of facilities may be reported in volume (for landfills especially) or weight per unit of time, usually in cubic metres per day or in tonnes per year.

Remark:

- Where pre-treatment of waste is important data should also be collected on pre-treatment facilities.

4B.2 Management of waste: Hazardous waste (Topic 3.3.2.b)

Hazardous waste is a special group of waste that, due to its toxic or other hazardous character, requires special management and is controlled by law in many countries. Hazardous waste is defined by the Basel Convention, a multilateral environmental agreement adopted in 1989, entering into force in 1992, which focuses on the control of transboundary movements of hazardous waste across international borders and establishes criteria for the environmentally sound management of such waste. The Basel Convention Article 1, provides a list of hazardous wastes.³⁸ It also allows for nationally defined hazardous wastes which are not covered in the Convention. Note that the Convention does not cover radioactive wastes or wastes from the operation of a ship, which may be hazardous.

This may take the form of specific definitions at regional or local level, for example, the European Union Regulation (EC) No 1013/2006 implements into law the provisions of the Convention.³⁹ Further European Union legislation provides definitions of hazardous waste under the List of Wastes and on the sound management of this specific waste stream applicable to the EU.^{40 41}

Annex IV A to the Basel Convention sets out a list of disposal operations applicable to hazardous wastes which do not lead to the possibility of resource recovery, recycling, reclamation or direct re-use or alternative uses; and Annex IV B sets out operations applicable to resource recovery, recycling, reclamation or direct re-use.⁴² Under the Basel Convention appropriate treatment is not defined, however, for hazardous waste landfilling is not considered a treatment.

(Management of) Hazardous waste (3.3.2.b)

Total hazardous waste collected (3.3.2.b.1)

The amount of hazardous waste collected for treatment or disposal (measured by weight).

Remark:

- Important indicators for the status of waste management, such as collection coverage or share of collected to generated waste also require statistics on hazardous waste generated.

Amount of hazardous waste treated by type of treatment and disposal (FDES 3.3.2.b.2)

Amount of hazardous waste collected that has been treated and disposed of (measured by weight).

Types of treatment include landfilling (controlled or not), incineration (with or without energy recovery), recycling and other facilities.

³⁸ Basel Convention and United Nations Environment Programme (1989) *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, <http://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf> (accessed 18 October 2018)

³⁹ European Union (2006) *Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste*, <http://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32006R1013> (accessed 14 October 2018)

⁴⁰ European Union (2014) *Commission Regulation (EU) No 1357/2014 of 18 December 2014 replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives Text with EEA relevance*, <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014R1357> (accessed 18 October 2018)

⁴¹ European Union (2014) *2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council Text with EEA relevance*, <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32014D0955> (accessed 14 October 2018)

⁴² United Nations Environment Programme and Basel Convention (1992) *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, <http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32008L0098> (accessed 15 October 2018)

Number of hazardous waste treatment and disposal facilities (FDES 3.3.2.b.3)

Hazardous waste treatment and disposal facilities should be specified by type of treatment. Types of treatment include landfilling (controlled or not), incineration (with or without energy recovery), recycling and other facilities.

Remarks:

- Hazardous waste may also be incinerated in permitted industrial high temperature facilities such as cement kilns.
- Where pre-treatment of waste is important data should also be collected on pre-treatment facilities.

Capacity of hazardous waste treatment and disposal facilities (FDES 3.3.2.b.4)

The capacities of hazardous waste treatment and disposal facilities should be disaggregated by type of treatment. Types of treatment include incineration facilities (with or without energy recovery), landfilling (controlled or not), recycling and other facilities.

Capacity of facilities may be reported in volume (for landfills especially) or weight per unit of time, usually in cubic metres per day or in tonnes per year.

Remarks:

- Where hazardous waste is incinerated in permitted industrial high temperature facilities such as cement kilns the capacity of these facilities should be included.
- For co-incineration plants, the total capacity of the plant (e.g., tons of cement) should not be reported but the capacity of waste that is permitted to be co-incinerated.
- Where pre-treatment of waste is important data should also be collected on pre-treatment facilities.

4B.3 Management of waste: Other/industrial waste (Topic 3.3.2.c)

Other/industrial waste consists of all the waste that is not included in 3.3.2.a Municipal waste or 3.3.2.b Hazardous waste, namely, that is not hazardous and not collected by the municipal waste collection system. Other/industrial waste can be generated by all economic activities.

(Management of) Other/industrial waste (FDES 3.3.2.c)

Total other/industrial waste collected (FDES 3.3.2.c.1)

The amount of waste collected for treatment or disposal (measured by weight).

Remark:

- Important indicators for the status of waste management, such as collection coverage or share of collected to generated waste also require statistics on hazardous waste generated.

Amount of other/industrial waste treated by type of treatment and disposal (FDES 3.3.2.c.2)

Amount of other/industrial waste that has been treated by type of treatment. Types of treatment include landfilling (controlled or not), incineration (with or without energy recovery), recycling, composting and other.

Remark:

- There is the potential for double counting of secondary waste, which is the re-treatment or disposal of the final waste treatment from MBT or sorting operations. For example, residues of incineration which are landfilled or residues from composting which are incinerated. Current practices recommend that secondary wastes should not be included.

Number of other/industrial waste treatment and disposal facilities (FDES 3.3.2.c.3)

Waste treatment and disposal facilities should be disaggregated by type of treatment. Types of treatment include with- or without energy recovery, landfilling (controlled or not), recycling, composting and other facilities.

Remarks:

- In some data collections there may be overlap of hazardous and other/industrial waste. In these cases, the number of treatment facilities for hazardous waste should be indicated. For example, landfills could be broken down by landfill type where data are available (landfills for hazardous, non-hazardous and inert waste).
- Where pre-treatment of waste is important data should also be collected on pre-treatment facilities.

Capacity of other/industrial waste treatment and disposal facilities (FDES 3.3.2.c.4)

The capacities of industrial waste treatment and disposal facilities should be disaggregated by type of treatment. Types of treatment include with- or without energy recovery, landfilling (controlled or not), recycling, composting and other facilities.

Capacity of facilities may be reported in volume (for landfills especially) or weight per unit of time, usually in cubic metres per day or in tonnes per year.

Remarks:

- In some data collections there may be overlap of hazardous and other/industrial waste. In these cases, the capacity of treatment facilities for hazardous waste should be indicated. For example, landfills could be broken down by landfill type where data are available (landfills for hazardous, non-hazardous and inert waste).
- Where pre-treatment of waste is important data should also be collected on pre-treatment facilities.

4C. Management of waste and the waste hierarchy

The following figure indicates how the waste treatment and disposal definitions used in international sources align to the levels of the waste hierarchy. The UNSD/UNEP Questionnaire 2018 on Environment Statistics as well as the other sources, provide statistics which can be used to monitor waste treatment and disposal according to the framework of the waste hierarchy.

Figure 4.1: Terms in the Waste Hierarchy mapped to the UNSD/UNEP Questionnaire 2018 on Environment Statistics, the Joint OECD/Eurostat Questionnaire on the State of the Environment and the European Union Directive on Waste

UNSD/UNEP Questionnaire 2018 on Environment Statistics	Joint OECD/Eurostat Questionnaire on the State of the Environment	European Union Waste Framework Directive 2008/98/EC
Prevention (FDES Component 2)		
This occurs before waste is generated and is not included in the UNSD/UNEP or OECD/Eurostat questionnaires on Waste. It can be determined from material flow accounting using statistics from Component 2 of the FDES 2013.	This occurs before waste is generated and is not included in the UNSD/UNEP or OECD/Eurostat questionnaires on Waste. It can be determined from material flow accounting using statistics from Component 2 of the FDES 2013.	Prevention means measures taken before a substance, material or product has become waste, that reduce: (a) the quantity of waste, including through the re-use of products or the extension of the life span of products; (b) the adverse impacts of the generated waste on the environment and human health; or (c) the content of harmful substances in materials and products.
Reuse		
Reuse occurs before waste enters the waste stream, while the questionnaire covers waste statistics.	Reuse - re-use shall mean any operation by which end-of-life products and equipment (e.g., electrical and electronic equipment) or its components are used for the same purpose for which they were conceived. The OECD/Eurostat Questionnaire defines reuse as a recovery operation. Recovery is defined as any waste management operation that diverts a	Re-use means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived; Preparation for re-use - means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they

UNSD/UNEP Questionnaire 2018 on Environment Statistics	Joint OECD/Eurostat Questionnaire on the State of the Environment	European Union Waste Framework Directive 2008/98/EC
	waste material from the waste stream and which results in a certain product with a potential economic or ecological benefit.	can be re-used without any other pre-processing.
Recycling (FDES 3.3.2.a.2, 3.3.2.b.2, 3.3.2.c.2)		
<p>Recycling - any reprocessing of waste material in a production process that diverts it from the waste stream, except reuse as fuel. Both reprocessing as the same type of product, and for different purposes should be included. Recycling within industrial plants i.e., at the place of generation should be excluded.</p>	<p>Recycling is defined as any reprocessing of material in a production process that diverts it from the waste stream, except reuse as fuel. Both reprocessing as the same type of product, and for different purposes should be included.</p> <p>The OECD/Eurostat Questionnaire includes the term recovery: Recovery is defined as any waste management operation that diverts a waste material from the waste stream and which results in a certain product with a potential economic or ecological benefit. Recovery mainly refers to the following operations: material recovery, i.e., recycling, energy recovery, i.e., re-use as fuel, biological recovery, e.g., composting, methanisation and re-use. The term recovery is not used in the UNSD/UNEP Questionnaire.</p>	<p>Recovery means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy.</p> <p>Recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.</p>
<p>Composting - biological process that submits biodegradable waste to anaerobic or aerobic decomposition, and that results in a product that is recovered and can be used to increase soil fertility.</p>	<p>Biological recovery, e.g., composting, methanisation</p> <p>Biological process that submits biodegradable waste to anaerobic or aerobic decomposition, and that results in a product that is recovered.</p>	

UNSD/UNEP Questionnaire 2018 on Environment Statistics	Joint OECD/Eurostat Questionnaire on the State of the Environment	European Union Waste Framework Directive 2008/98/EC
Energy recovery (FDES 3.3.2.a.2, 3.3.2.b.2, 3.3.2.c.2)		
Incineration with energy recovery - incineration in which evolving thermal energy is used for the production of steam, hot water or electric energy.	Energy recovery (re-use as fuel)	Other recovery, e.g., energy recovery.
Disposal (FDES 3.3.2.a.2, 3.3.2.b.2, 3.3.2.c.2)		
Incineration - the controlled combustion of waste with or without energy recovery.	Incineration without energy recovery.	Disposal means any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy.
Landfilling - final placement of waste into or onto the land in a controlled or uncontrolled way. The definition covers both landfilling in internal sites (i.e., where a generator of waste is carrying out its own waste disposal at the place of generation) and in external sites.	<p>Final treatment or disposal</p> <p>Final treatment - the physical, thermal, chemical or biological processes, that change the characteristics of the waste in order to reduce its volume or hazardous nature, and that results in a product that goes to final disposal.</p> <p>Disposal is defined as any waste management operation serving or carrying out the final treatment and disposal of waste. Including final treatment – incineration without energy recovery; biological, physical, chemical treatment resulting in products or residues that are discarded, i.e., going to final disposal. Final disposal includes deposit into or onto land, including specially engineered landfill, deep injection, surface impoundment, release into water bodies or permanent storage.</p>	

UNSD/UNEP Questionnaire 2018 on Environment Statistics	Joint OECD/Eurostat Questionnaire on the State of the Environment	European Union Waste Framework Directive 2008/98/EC
<p>Controlled landfilling - final placement of waste into or onto the land in a controlled landfill site.</p>	<p>Landfill is defined as deposit of waste into or onto land, including specially engineered landfill, and temporary storage of over one year on permanent sites.</p> <p>Controlled landfill whose operation is submitted to a permit system and to technical control procedures in compliance with the national legislation in force. Includes specially engineered landfill.</p> <p>Specially engineered landfill e.g., placement into lined discrete cells which are capped and isolated from one another and the environment.</p>	
<p>Other (waste treatment/disposal) - any final treatment or disposal different from recycling, composting, incineration and landfilling. Examples include releasing into water bodies and permanent storage.</p> <p>Other (waste treatment/disposal for hazardous waste) - any final treatment or disposal different from recycling, incineration and landfilling. Examples include physical/chemical treatment, biological treatment, releasing into water bodies and permanent storage.</p>		

4D. Recycling

Amount of recycled waste (FDES 3.3.2.d)

The definition in the UNSD/UNEP Questionnaire 2018 on Environment Statistics is:⁴³

Recycled waste is waste material reprocessed in a production process that diverts it from the waste stream, except reuse as fuel. Both reprocessing as the same type of product, and for different purposes should be included. Recycling within industrial plants i.e., at the place of generation should be excluded.⁴⁴

However, other aspects of waste recovery may be relevant in providing statistics to inform the circular economy. The UNSD/UNEP Questionnaire also defines:

- Composting - A biological process that submits biodegradable waste to anaerobic or aerobic decomposition, and that results in a product that is recovered and can be used to increase soil fertility.
- Incineration with energy recovery - Incineration in which evolving thermal energy is used for the production of steam, hot water or electric energy.

Note that waste material undergoing internal recycling, i.e., directly at the place of generation, is excluded as it does not enter the waste cycle.

Other definitions are provided for comparison, these are harmonized with the above definition.

Joint OECD/Eurostat Questionnaire on the State of the Environment⁴⁵

The Joint OECD/Eurostat Questionnaire on the State of the Environment uses the term recovery to cover the aspects of waste recovery, with recycling under the term material recovery.

Recovery is defined as any waste management operation that diverts a waste material from the waste stream and which results in a certain product with a potential economic or ecological benefit.

Recovery mainly refers to the following operations:

- material recovery, i.e., recycling
- energy recovery, i.e., re-use as fuel
- biological recovery, e.g., composting, methanisation
- re-use

Direct recycling or reuse within industrial plants at the place of generation and on-site composting are excluded.

Recycling is defined as any reprocessing of material in a production process that diverts it from the waste stream, except reuse as fuel. Both reprocessing as the same type of product, and for different purposes should be included.

Composting is a biological process that submits biodegradable waste to anaerobic or aerobic decomposition, and that results in a product that is recovered.

Re-use shall mean any operation by which end-of-life products and equipment (e.g., electrical and electronic equipment) or its components are used for the same purpose for which they were conceived.

⁴³ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

⁴⁴ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

⁴⁵ OECD/Eurostat (2014) *Joint OECD/Eurostat Questionnaire on the State of the Environment*, Paris

European Union⁴⁶

Under the EU Waste Framework Directive⁴⁷ recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.

Remarks:

- Under the Waste Framework Directive recycling includes composting, which is a separate term in the UNSD/UNEP Questionnaire 2018 on Environment Statistics. Under the Joint OECD/Eurostat Questionnaire on the State of the Environment material recovery covers recycling, while biological recovery covers composting.
- The concepts of recovery and recycling raise the issue of when waste ceases to be waste (end-of-waste status). The EU Waste Framework Directive specifies that certain specified waste shall cease to be waste ... when it has undergone a recovery, including recycling, operation and complies with specific criteria to be developed in accordance with the following conditions:
 - a) The substance or object is commonly used for specific purposes;
 - b) A market or demand exists for such a substance or object;
 - c) The substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and
 - d) The substance or object will not lead to overall adverse environmental or human health impacts.

The criteria shall include limit values for pollutants where necessary and shall take into account any possible adverse environmental effects of the substance or object.

⁴⁶ European Union (2008) *Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives*, <http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32008L0098> (accessed 15 October 2018)

⁴⁷ European Union (2008) *Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives*, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN> (accessed 14 October 2018)

4E. Imports and exports

This section discusses the inclusion/exclusion of imports and exports of waste and municipal waste in waste generation and waste treatment.

Waste statistics need to include imports and exports in the totals. Various practices are outlined below. Waste treatment can cover various concepts; therefore, metadata should state how imports and exports have been dealt with and the concept covered. Care should be taken in deciding the concept required, e.g., waste treated in the country, or treatment related to waste generated in a country. Some practices are:

Waste generated includes waste generated in a country which is exported but excludes imports. Waste material undergoing internal recycling, i.e., directly at the place of generation, is excluded as it does not enter the waste cycle.⁴⁸

Waste treated or disposed when covering waste treated or disposed *in a country* includes imports, but excludes exports.⁴⁹ However, when waste treated is related to waste generated in certain indicators, e.g., recycling rates, waste treated excludes imports of waste for treatment but includes exports to ensure that the numerator and denominator are covering the same scope.

Municipal waste treated

Various concepts can be covered, e.g., *municipal waste managed in a country* which includes waste imported for treatment/disposal and excludes waste exported for treatment/disposal,⁵⁰ or *treatment of municipal waste generated in a country*, which includes exports of municipal waste for treatment/disposal but excludes imports for treatment/disposal.⁵¹

Imports of waste (FDES 3.3.2.e)

Quantity of waste that is imported for treatment from outside the country/territory, e.g., if the importing country can provide more appropriate treatment facilities.

Remarks:

- Data on imports of waste are often only available for hazardous and other waste which requires notification of transport, e.g., according to the EU Waste Shipments Regulation. Waste may be recorded under the customs code of the original product leading to difficulties in identifying it as waste, e.g., waste imported for recycling may be recorded under textiles.
- In some countries illegal imports of waste for illegal recovery and disposal is a considerable problem. These are not part of official waste statistics but can be estimated separately (e.g., from national compliance and enforcement authorities) and mentioned in footnotes of the data.

⁴⁸ Eurostat *Waste Statistics* webpage, http://ec.europa.eu/eurostat/cache/metadata/en/env_wasgt_esms.htm (accessed 15 October 2018)

⁴⁹ Eurostat *Waste Statistics* webpage, http://ec.europa.eu/eurostat/cache/metadata/en/env_wasgt_esms.htm (accessed 15 October 2018)

⁵⁰ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

⁵¹ Eurostat (2016) *Guidance on municipal waste data collection*, May 2017,

<https://ec.europa.eu/eurostat/documents/342366/351811/Guidance+on+municipal+waste+reporting/0710f1a4-6b68-4d48-ac4c-75901bc0644b> (accessed 15 October 2018)

Exports of waste (FDES 3.3.2.f)

Quantity of waste that is exported for treatment outside the country/territory. Waste statistics should ideally include the amounts of waste (hazardous, non-hazardous) exported for treatment to allow for the calculation of correct national recycling rates, which is difficult if the amounts treated outside the country are not known.

Remark:

- In some countries illegal exports of waste (e.g., end-of-life-vehicles, hazardous waste, etc.) are a considerable problem. These are not part of official statistics but can be estimated separately (e.g., from national compliance and enforcement authorities) and mentioned in footnotes of the data.

Imports of hazardous waste (FDES 3.3.2.g)

Quantity of hazardous waste that is imported for treatment from outside the country/territory.

Exports of hazardous waste (FDES 3.3.2.h)

Quantity of hazardous waste that is exported for treatment outside the country/territory.

5. International sources and recommendations

5A. Classifications and groupings

5A1. Classification of economic activity

When possible, waste statistics generated by economic activity should be based on ISIC Rev. 4.

The groupings used for the UNSD/UNEP Questionnaire 2018 on Environment Statistics⁵² for collection of statistics on waste generated are:

- Agriculture, forestry and fishing (ISIC 01-03)
- Mining and quarrying (ISIC 05-09)
- Manufacturing (ISIC 10-33)
- Electricity, gas, steam and air conditioning supply (ISIC 35)
- Construction (ISIC 41-43)
- Other economic activities, excluding ISIC 38
- Households

The following ISIC divisions are not included above: Division 36 Water collection, treatment and supply and Division 37 Sewerage are collected under water statistics. Division 38 Waste collection, treatment and disposal activities, materials recovery have not been included when collecting statistics on waste generated for practical purposes: to avoid double counting of waste from other economic sectors.

5A2. UNECE Standard Statistical Classification of Wastes 1993 (draft)

The classification covers types of waste generated, wastes by source, recycling and reuse of materials, treatment and disposal of non-hazardous waste and hazardous wastes.

5A3. European Waste Classification for Statistics (EWC-Stat)^{53 54}

The EWC-Stat Rev.4 is a statistical classification of waste used by Eurostat for reporting statistical data on waste generation and waste treatment. It aggregates the waste types in the European List of Wastes (LoW) by substance. The LoW is the waste classification used in the EU for administrative purposes, e.g., permitting and supervision in the field of waste generation and management. Countries may collect data using the LoW and convert it to the EWC-Stat for reporting.

⁵² United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

⁵³ European Commission (2010) *Commission Regulation 849/2010 amending 2150/2002 of the European Parliament and of the Council on Waste Statistics*, Official Journal of the European Union L253/2 28.9.2010, http://ec.europa.eu/eurostat/ramon/other_documents/ewc_stat_4/index.cfm?TargetUrl=DSP_EWC_STAT_4 (accessed 14 October 2018)

⁵⁴ Eurostat (2002) *Guidance on classification of waste according to EWC-Stat categories*, <http://ec.europa.eu/eurostat/documents/342366/351806/Guidance-on-EWCStat-categories-2010.pdf/0e7cd3fc-c05c-47a7-818f-1c2421e55604> (accessed 14 October 2018)

5A4. Hazardous waste

Hazardous waste is defined by the Basel Convention, see section 4B.2 for further detail.

5B. Reference to international recommendations, frameworks and standards

International organizations have produced guidance documents and have set standards for the collection of waste data, e.g., for the monitoring of policy targets and/or implementation of waste legislation and international conventions (non-exhaustive list):

- [UNSD/UNEP Questionnaire 2018 on Environment Statistics](#)⁵⁵ - contains definitions and diagrams for generation and treatment of waste by sources of waste, management of hazardous waste, management of municipal waste, and composition of municipal waste.
- [Joint OECD/Eurostat Questionnaire on the State of the Environment](#) - contains definitions on topics related to generation of waste by sector, generation, recovery and recycling of selected waste streams, generation of selected waste streams, generation, treatment and disposal of non-hazardous industrial waste, generation, treatment and disposal of hazardous waste, generation of hazardous waste by category, generation and collection of municipal waste, composition of municipal waste, treatment and disposal of municipal waste and waste treatment and disposal installations.
- [Basel Convention controlling transboundary movements of hazardous waste and their disposal](#) - the webpage provides information on the definition of hazardous waste, the electronic reporting system, on webinars and workshops and contains a link to the data visualization tool.
- [European Union and Eurostat](#) - Eurostat provides guidance to European Union countries for reporting on waste statistics which is governed by the EU regulations No. 2150/2002,⁵⁶ 574/2004,⁵⁷ 783/2005,⁵⁸ 782/2005⁵⁹ and 1445/2005.⁶⁰ Waste is defined under the Directive 2008/98/EC, the European Waste Framework Directive,⁶¹ amended by Directive (EU) 2018/851⁶². The directives cover the concepts and definitions related to waste management, end of waste and by-products of waste. Its annexes list disposal (Annex I) and recovery operations (Annex II).

⁵⁵ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

⁵⁶ European Union (2002) *Regulation (EC) No 2150/2002 on waste statistics*, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002R2150&from=EN> (accessed 14 October 2018)

⁵⁷ European Union (2004) *Regulation (EC) No 574/2004 amending Annexes 1 and III to Regulation (EC) No 2150/2002*, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004R0574&qid=1536610069206&from=EN> (accessed 14 October 2018)

⁵⁸ European Union (2005) *Regulation (EC) No 783/2005 of 24 May 2005 amending Annex II to Regulation (EC) No 2150/2002*, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32005R0783&qid=1536610150957&from=EN> (accessed 14 October 2018)

⁵⁹ European Union (2005) *Regulation (EC) No 782/2005 of 24 May 2005 setting out the format for the transmission of results on waste statistics*, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32005R0782&qid=1536610254736&from=EN> (accessed 14 October 2018)

⁶⁰ European Union (2005) *Regulation (EC) No 1445/2005 of 5 September 2005 defining the proper quality evaluation criteria and the contents of the quality reports for waste statistics for the purposes of Regulation (EC) No 2150/2002*, <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:229:0006:0012:EN:PDF> (accessed 14 October 2018)

⁶¹ European Union (2008) *Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives*, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0098&from=EN> (accessed 14 October 2018)

⁶² European Union (2015) *Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste*, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018L0851> (accessed 17 October 2018)

- [Intergovernmental Panel on Climate Change 2006 IPCC Guidelines for National Greenhouse Gas Inventories, ⁶³ Vol 5 on Waste](#) provides guidance on estimating greenhouse gases from solid waste disposal, biological treatment of solid waste, incineration and open burning of waste and wastewater treatment and discharge.

5C. Sources of global and regional environment statistics and indicators series

Many regional and international bodies publish environment statistics and indicators on waste. They are produced to monitor implementation of specific legislation or to follow up policy strategies, e.g., on waste reduction or resource efficiency. The country coverage, as well as the types of waste included (e.g., WEEE waste, municipal waste, hazardous waste) and treatment operations, is often limited to the requirements of the legislation or policy strategies in force.

- [United Nations Statistics Division](#) - collects data using the UNSD/UNEP Questionnaire on Environment Statistics (latest round 2018), for non-OECD/Eurostat countries. Data for OECD and Eurostat comes from the Joint OECD/Eurostat Questionnaire on the State of the Environment. Data are published by UNSD for all countries on generation and treatment of waste by sources of waste, management of hazardous waste, management of municipal waste, composition of municipal waste.
- [European Union](#) - the European Union has compiled data on waste starting in 2004, reference year 2003. Data are published at the Waste Data Centre at Eurostat: total waste arising and management for e-waste, batteries, end-of-life vehicles, packaging waste, municipal waste, hazardous waste in the EU.
- [OECD Environment Directorate](#) - collects data from the Joint OECD/Eurostat Questionnaire on the State of the Environment for OECD and EU countries. It should be noted that as of 2002 with the introduction of the EU Waste Framework Directive, waste data for EU countries are collected under the EU regulation on waste statistics not the OECD/Eurostat Questionnaire (first statistics reference year 2004). EU countries use the OECD/Eurostat Questionnaire only for municipal waste.

The OECD covers generation of waste by sector; generation, recovery and recycling of selected waste streams; generation, treatment and disposal of non-hazardous industrial waste; generation, treatment and disposal of hazardous waste; generation and collection of municipal waste; composition of municipal waste; treatment and disposal of municipal waste; and waste treatment and disposal installations. Data are also provided to inform on resource productivity and waste.

⁶³ IPCC (2006) *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol 5, Waste*, <https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html> (accessed 13 October 2018)

6. Data collection and sources of data

Scope

The scope comprises waste generated, treated and disposed. For treatment of imports and exports, see section 4E. Imports and exports.

Issues in practice:

- Data collected as national data may actually cover only major cities in urban regions as rural areas may not be served by waste management. However, rural households often generate low levels of waste and often reuse waste, e.g., composting or disposal in situ, e.g., by burning or burial. The number of and actual cities covered may also vary from year to year.
- Waste is managed through several players, e.g., waste may be collected through government operated collectors, through private concessionaires contracted by government, through private collectors operating independently or through private businesses taking waste directly to recycling or landfill sites or through extended producer responsibility systems. There may also be private disposal and treatment, such as home composting. The variety of players creates difficulties in collecting comprehensive data on waste management, for example, for municipal waste, only data from government operated or contracted operators may be collected. Comprehensive data on waste may therefore not be possible and in addition, it may be more difficult to collect data on certain waste, e.g., those collected privately.
- The scope of national data on waste usually does not cover illegal or uncontrolled collection, treatment or disposal, e.g., open dumping, nor on informal sector activities which have not been incorporated into (formal) waste management, such as informal recycling. Where the informal sector has been incorporated into waste management and collects waste on behalf of municipalities, this data is included under the scope.
- When the weight of waste is estimated by volume this can be less accurate than waste which is weighed. Upgrading of treatment sites to allow weighing of waste can cause breaks in the time series which reflects the change in method.
- Despite the existence of international and regional definitions, in practice, these may not be followed due to difficulties in collecting data according to the definition. For example, municipal waste may or may not include the following depending on whether these are collected by municipal authorities: construction and demolition waste; sewage sludges; office and services waste; waste from small industries and the services sector; waste batteries or waste electrical and electronic equipment (WEEE).⁶⁴ In some countries production waste cannot be excluded from household or municipal waste due to the nature of waste collection.
- Significant overlap exists between waste concepts, e.g., hazardous waste is not mutually exclusive with waste from households; and municipal waste and household waste may overlap.

⁶⁴ OECD (2015) *Environment at a Glance 2015: OECD Indicators*, OECD, Paris, <http://www.oecd.org/env/environment-at-a-glance-19964064.htm> (accessed 15 October 2018)

- Recycled municipal waste also contains packaging waste, which can be a substantial portion of municipal waste recycled. However, some countries do not include recycled packaging waste from households in reporting on municipal waste while others do. Where private operators of packaging waste recycling schemes do not disaggregate sources, then quantities of municipal waste recycled can be underestimated.
- Hazardous waste may refer only to waste from hospitals or health care centres not to all sectors. Another common type of hazardous waste for which statistics are collected is Persistent Organic Pollutants and pesticides.

Issues pertaining to pre-treatment⁶⁵

- Collected waste may be temporarily stored and therefore may not be included in waste treated in that year. When the amount stored between years varies from the trend this can cause a decrease or increase in waste treated. In addition, when waste is stored the quantities generated and treated may not be coherent in any one year.
- For waste that is pre-treated, the total quantity may be classified and assigned to the treatment type recorded for the waste facility, despite undergoing different treatments in the facility. For instance, according to Eurostat guidance, in compiling statistics, the quantity of pre-treated waste should be assigned to its final outputs.⁶⁶ However, in a dedicated facility which may be classified as a recycling or composting facility, when waste undergoes pre-treatment such as sorting or MBT, the amount allocated to the final treatment options may not be known. The entirety of the waste arriving at the facility is therefore allocated to recycling or composting, which would result in an overestimation, as non-recyclable or non-composting residues generated during the sorting/screening stage of pre-treatment should not be included. In cases where sorting or recycling occurs at landfills or composting plants, the whole amount of waste may be allocated to these treatments while the amount for recycling is underestimated.⁶⁷

A common statistical issue has been that waste was measured only as it entered the facility so that further disaggregation into the different treatments was not measured. In some countries, the whole amount received at the plant is recorded as recycled or composted, while in other countries only the actual amount recycled after the MBT was included and the amount sent to landfilling or incineration excluded. For the former countries, composting and recycling may thus be overestimated as the statistic includes discarded waste, while amounts for landfilling and incineration are underestimated.

- Sometimes waste can go through different treatment stages and can therefore be double counted, such as after recovery and disposal operations. For example, after waste processing the output from the treatment facility is counted again as waste.

⁶⁵ Eurostat (2017) *Country specific notes on municipal waste data: last update September 2017*, <http://ec.europa.eu/eurostat/documents/342366/351758/Footnotes-MW/d0579b7d-a998-47d1-b983-fa384509da1a> (accessed 15 October 2018)

⁶⁶ Eurostat (2016) *Guidance on municipal waste data collection*, May 2017, <http://ec.europa.eu/eurostat/documents/342366/351811/Municipal+Waste+guidance/bd38a449-7d30-44b6-a39f-8a20a9e67af2> (accessed 18 October 2018)

⁶⁷ Eurostat (2016) *Guidance on municipal waste data collection*, May 2017, <http://ec.europa.eu/eurostat/documents/342366/351811/Municipal+Waste+guidance/bd38a449-7d30-44b6-a39f-8a20a9e67af2> (accessed 18 October 2018)

Statistical unit

Waste generated: data may be collected via surveys of the economic activities that generate the waste. However, it is more common to base the data collection on the establishments engaged in the collection and treatment of waste and estimate the generated amount from the amount collected and treated. In both cases the reporting units are the economic units (establishments).

Waste treatment: The statistical units are the economic units that collect or treat waste, for example, waste collectors or waste treatment operators.

Measurement units

Waste should be measured in weight. The measurement unit used for all waste is tonnes of normal wet weight per year. However, for 'sludge', such as industrial effluent sludge or common sludge this would seriously reduce the comparability as this type of waste contains very different fractions of water; for sludge the conversion from wet to dry weight is highly recommended.

Waste reported in volumes (cubic metres) should be converted to weight (tonnes) by the application of waste conversion factors.

Sources and institutions

Waste generated: It should be noted that statistics on waste generated are usually not available and are estimated from statistics on waste collected, available from the records of the economic units engaged in waste collection, treatment and disposal.⁶⁸ Waste factors are applied to waste-related activities or causal models developed using data on waste treatment or waste collection. For example, waste factors can establish the relation between the production of a certain product and the quantity of waste generated during production applied to waste-related activities. This method is mostly used for basic products where production techniques do not change and where the product is simple enough to generate waste factors, such as in agriculture.⁶⁹

Other methods of estimation use economic indicators based on economic data to estimate household waste and agricultural data for agricultural waste.⁷⁰ For example, estimates of household waste generated have been produced based on models of waste generation per unit of consumer expenditure.

Statistics on waste generated may use data gathered from waste treatment reports from waste treatment facilities, although in this case it is difficult to identify the source or sector of the waste and requires that all waste goes to treatment.⁷¹ Other methods of data collection include business surveys of selected economic sectors or household surveys of private households – often to obtain waste generation rates.

Combinations of methods are often used, and issues of double counting or omission can arise. Use of several methods can also result in non-comparability between countries. For example, estimates of waste oils may be estimated based on operating vehicles or estimated from data from waste oil collectors, which may not cover all waste oils.

⁶⁸ United Nations Statistics Division (2017) *Framework for the Development of Environment Statistics (FDES 2013)*, <https://unstats.un.org/unsd/environment/fdes/FDES-2015-supporting-tools/FDES.pdf> (accessed 15 October 2018)

⁶⁹ Eurostat (2010) *Manual on Waste Statistics*, Luxembourg, Eurostat, <http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-RA-13-015> (accessed 15 October 2018)

⁷⁰ Eurostat (2010) *Manual on Waste Statistics*, Luxembourg, Eurostat, <http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-RA-13-015> (accessed 15 October 2018)

⁷¹ Eurostat (2010) *Manual on Waste Statistics*, Luxembourg, Eurostat, <http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-RA-13-015> (accessed 15 October 2018)

Construction and demolition waste may be re-used on site and would not occur in accounts from waste collectors but would appear if construction and demolition companies are surveyed directly.

Waste management: Waste management data for commercial, industrial and business sectors, are most often collected using enterprise surveys or administrative data from waste treatment facilities, or a mixture of both. Data are most often from the point of deposit of the waste rather than the point of collection. In addition, data may be obtained from other sources, such as:

- Public institutions - environment agencies and other supervising authorities responsible for the implementation of national waste legislation or related legal acts, e.g., on fees, taxes and permits for generation and management of waste, sectoral ministries;
- Associations and organisations in the public sector which organise or handle specific aspects of waste management (collectors, transporters, 'dual systems', oil collectors, etc.);
- Others - such as international reporting obligations under specific treaties or conventions.

Types of data include administrative data collected for licensing and monitoring such as facility registers, consignment notes or waste management reports. Reports may also be obtained from industrial or public associations and from monitoring of waste products.

Municipal waste: is waste for which data are regularly available although national coverage may be incomplete, with data available only for particular cities. Data are obtained from the administrative records of waste collectors and/or by the municipality that regulates or directly performs this service. Detail on the level and nature of service by neighbourhood may only be possible for collectors contracted by the municipality. The quantity of waste collected may be available from weight records at the disposal sites or estimated from volumes. Depending on the nature of the collection and disposal (e.g., source segregated, pre-treatment of mixed municipal waste), the records of the collectors or treatment facilities may allow for further disaggregation of the waste statistics.

When the informal sector has been incorporated into waste management and collects data on behalf of municipalities, waste collected by the informal sector may be included in official waste statistics. For example, informal recycling which is carried out by waste pickers, waste collection service workers or by middle men dealing in waste. Ancillary data may be collected from surveys of informal recycling organisations to determine the 'number of informal waste workers involved in collection activities', the 'amounts collected daily per informal collector' and the 'number of working days' are used to estimate yearly recyclable amounts that are informally diverted from municipal solid waste.

In some countries, e.g., in several European countries, waste facility registers are available which are used to assist the competent authorities in the registration and licensing of waste treatment facilities, in the issuing of permits and in monitoring compliance with legal requirements. These registers can be used to identify the reporting units for waste statistics. The register contains data on the number and capacity of waste treatment facilities, specified by treatment of waste (incineration, recovery, recycling, landfilling) and on waste, such as municipal waste, hazardous waste, etc. In other countries, registers are not available, and a significant amount of waste treatment may be informal, e.g., recycling is often carried out by waste pickers in the town, by waste collection service workers, and by waste pickers at the landfill for whom no official registry exists. Waste is handled by middlemen who operate junkshops, in many cases registration of recyclers or recycling facilities may be set up, but this may be only partial.

Specific waste streams: Special data collections, case studies or estimations are often required for specific waste streams such as e-waste, food waste, construction and demolition waste, medical waste, etc. These areas may be of recent importance to policy makers, therefore methodologies may be experimental or in development. For example,

in the case of e-waste, experimental guidance has been produced by the United Nations University⁷² which sets out a methodology to estimate e-waste based on production, imports and exports of products, and estimated average lifespans of products.

Waste composition

Waste composition of municipal solid waste can be estimated using waste composition rates identified by special one-off surveys which conduct sampling, sorting and weighing of the individual components. The surveys can be conducted from waste collected from households/kerbside or from waste at disposal/treatment sites, such as landfill sites. Important considerations are the identification of the geographical area or household types generating the waste as composition, and therefore the rates obtained, varies with socio-economic level, by season and geographical location. These rates can then be applied to waste collected to obtain estimates of quantities.

Aggregation

How statistics on waste generated and waste treatment and disposal can be aggregated is discussed in Sections 3B to 3E. In general, waste statistics can be potentially aggregated by:

- Waste stream
- Composition of waste
- Sources of waste
- Waste treatment and disposal

Spatial and temporal issues

Difficulties may arise in obtaining spatially and temporally consistent statistics on waste at the national level as discussed above under “Scope: issues in practice”. Coverage can be national or sub-national (such as city for municipal waste).

Estimation

Conversion factors are often needed, e.g., waste volume to weight, usually determined by special studies as the factor needed depends on the characteristics of the waste and would be country specific. Some country examples are provided below; note that conversions are usually country specific, as the factor depends on the nature of the waste.

Some examples of factors used by countries for waste collected and treated, in data collected by UNSD/UNEP Questionnaire 2016 on Environment Statistics.⁷³ The following are provided for illustration only and are not an endorsement by the United Nations Statistics Division for use by other countries as factors are country specific.

- Belarus (municipal waste collected and treated): data are converted from cubic metres to tonnes using a waste density coefficient 0.18 tonnes/m³ as prescribed in the Order of the Ministry of Housing and Public Utility Services.
- Indonesia (municipal waste collected and treated): waste volume is converted to weight using 1 m³ of waste = 0.24 tonnes.

⁷² United Nations University (2015) *E-waste statistics: guidelines on classification, reporting and indicators 2015*, https://i.unu.edu/media/ias.unu.edu-en/project/2238/E-waste-Guidelines_Partnership_2015.pdf (accessed 15 October 2018)

⁷³ United Nations Statistics Division webpage *UNSD Environmental Indicators*, <https://unstats.un.org/unsd/envstats/gindicators.cshtml> (accessed 15 October 2018)

- Senegal (waste generated unpublished): annual waste generated is based on a factor of 0.5 kg per capita per day (figure provided by a study conducted by the Ministry of Environment) and population provided by the National Statistics and Demography Agency.

Examples of conversion factors and units of measurement used for waste statistics in Bosnia and Herzegovina, from the report “Framework on Waste Statistics, Report of the Economic Commission for Europe Task Force on Waste Statistics”.⁷⁴

- Građevinski otpad i otpad od rušenja objekata, Agency for Statistics of Bosnia and Herzegovina, 2013, http://www.bhas.ba/metodoloskidokumenti/RD_STAT_GRO_2013_001_01_Bos.pdf
- *Određivanje šifre otpada prema listi otpada*, Agency for Statistics of Bosnia and Herzegovina, 2012, http://www.bhas.ba/metodoloskidokumenti/LoW_2012_001_01_BA.pdf
- Waste Weight Determination, Agency for Statistics of Bosnia and Herzegovina, 2015, http://www.bhas.ba/metodoloskidokumenti/KFO_2015_001_01-en.pdf

Validation

Examples of good validation practices specific to waste statistics are:^{75 76}

- Checks of time series, i.e., unexpected increases or decreases of waste quantities over time. Trends in waste data may not be consistent – there may be large fluctuations or breaks in series, particularly in countries where waste management is still developing. For example, when municipal waste collection is extended to new neighbourhoods in a city, the volumes reported increases as the number of households covered by the municipal service increases. In countries where collection is not comprehensive, fluctuations also occur when new waste policies are implemented, for example, the introduction of monthly cleaning exercises, which increases the amount of waste collected or the introduction of new waste treatment methods, such as private composting or recycling companies. Fluctuations occur when waste management facilities improve, e.g., installation of weighbridges at disposal site, with statistics using direct data rather than estimation from volume to weight.
- International comparison may also vary, e.g., country data on municipal waste may include construction and demolition (this may cause large fluctuations in municipal waste data); may exclude waste from origins other than households; may exclude aluminium cans or metal containing waste if these are not part of municipal waste collection; and may also cover industrial waste from manufacturing, commercial and institutional sectors depending on the sectors managed by the solid waste concession.
- Detection of outliers based on indicators per value added, per number of persons employed or per capita (population).
- Analysis of the composition of waste for waste by economic activity to detect misclassification.
- Analysis of the percentage of hazardous waste per economic activity or per waste category (in the Basel Convention) to assess the proper distinction in hazardous/non-hazardous.
- Checks of the coherence of data on waste generation and waste treatment. Differences can occur due to import and export of waste or secondary waste being included in waste generation, time lags, drying processes, etc.
- Checks of coherence of data on waste treated and on waste treatment capacity.

⁷⁴ UNECE webpage, *Task Force on Waste Statistics*, <https://www.unece.org/statistics/networks-of-experts/task-force-on-waste-statistics.html> (accessed 17 October 2018)

⁷⁵ United Nations Statistics Division/United Nations Environment Programme (2018) *UNSD/UNEP Questionnaire 2018 on Environment Statistics*, https://unstats.un.org/unsd/envstats/Questionnaires/2018/q2018Waste_English.xls (accessed 14 October 2018)

⁷⁶ Eurostat (2010) *Manual on Waste Statistics*, Luxembourg, Eurostat, <http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-RA-13-015> (accessed 15 October 2018)

7. Uses and dissemination

7A. Potential presentation/dissemination formats

Figure 7.1: Generation of waste in Sweden (2016)

Tonnes

Industry	Waste generation 2016
Agriculture, forestry and fishing	804 400
Mining and quarrying	109 720 100
Manufacture of food products, beverages and tobacco products	869 700
Manufacture of textiles, wearing apparel and leather	16 100
Manufacture of wood and wood products	242 000
Manufacture of paper and paper products; printing and reproduction of recorded media	1 472 000
Manufacture of coke and refined petroleum products	18 200
Manufacture of chemicals and chemical products, pharmaceutical products, rubber and plastic products	327 600
Manufacture of other non-metallic mineral products	219 300
Manufacture of basic metals and metal products	1 702 700
Manufacture of computer, electronic and optical products, electrical equipment, machinery, motor vehicles and other transport equipment	777 400
Manufacture of furniture, other manufacturing and repair and installation of machinery and equipment	155 200
Electricity, gas, steam and air conditioning supply	1 861 600
Water supply, sewerage, waste management and remediation activities	232 200
Waste collection, treatment and disposal activities; materials recovery	6 190 100
Construction	9 811 000
Service activities	2 180 200
Wholesale of waste and scrap	615 100
Households	4 410 900
Total	141 625 700

Source: Statistics Sweden, Waste Statistics, <http://www.scb.se/en/finding-statistics/statistics-by-subject-area/environment/waste/waste-generated-and-treated/pong/tables-and-graphs/waste-generation/> (accessed 15 October 2018)

Shows generation of waste by economic sectors and households.

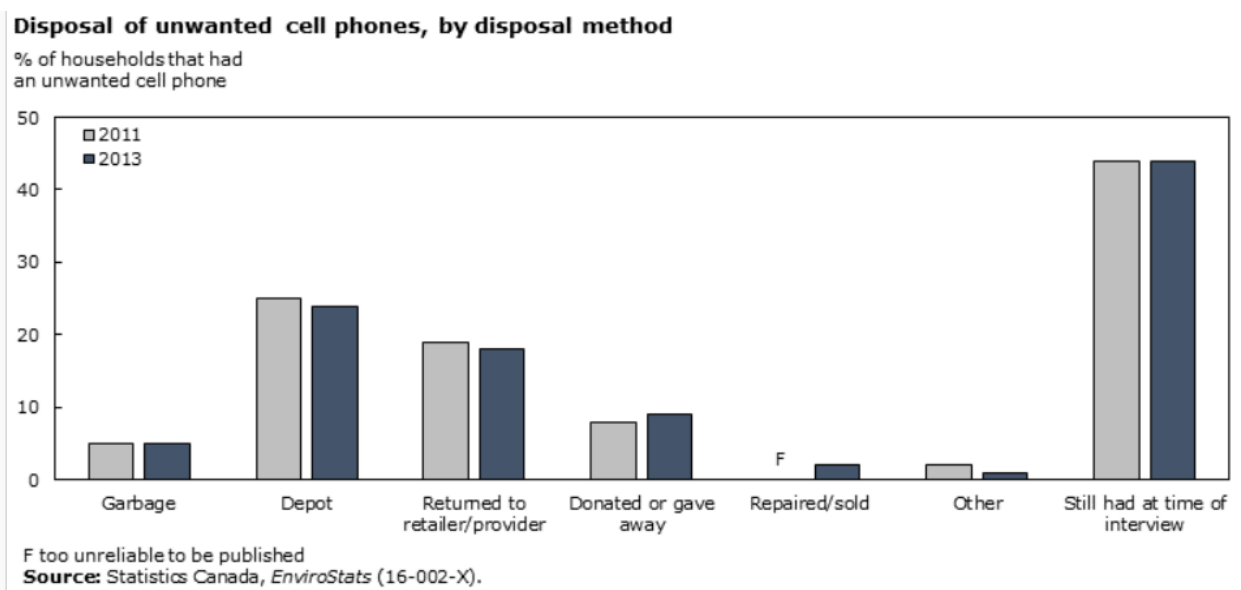
Figure 7.2: Household hazardous waste and household e-waste disposal, Canada, 2009

**Table 3.4
Household hazardous waste, 2009**

	Had the identified hazardous waste item to dispose of	Had the identified hazardous waste item to dispose of							Other
		Put them in the garbage	Took or sent them to a depot or drop-off centre	Returned them to a supplier or retailer	Poured them down the drain, sewer, ground, toilet or sink	Donated them or gave them away	Still had them		
		percent							
Medication	39	22	6	57	8	...	15	1 ^E	
Paint or solvents	39	4	62	8	...	...	31	2
Unwated engine oil or anti-freeze	15	1 ^E	61	19	...	...	18	4
Dead or unwanted car batteries	12	F	46	31	...	...	20	5 ^E
Other dead or unwanted batteries	58	42	35	7	...	...	18	4
Unwanted electronic devices	36	11	45	5	...	22	28	2	
Dead or unwanted compact fluorescent lights (CFLs)	22	56	24	...	...	4	13	3

Source(s): Statistics Canada, 2011, *Households and the Environment, 2009*, Catalogue no. 11-526-X.

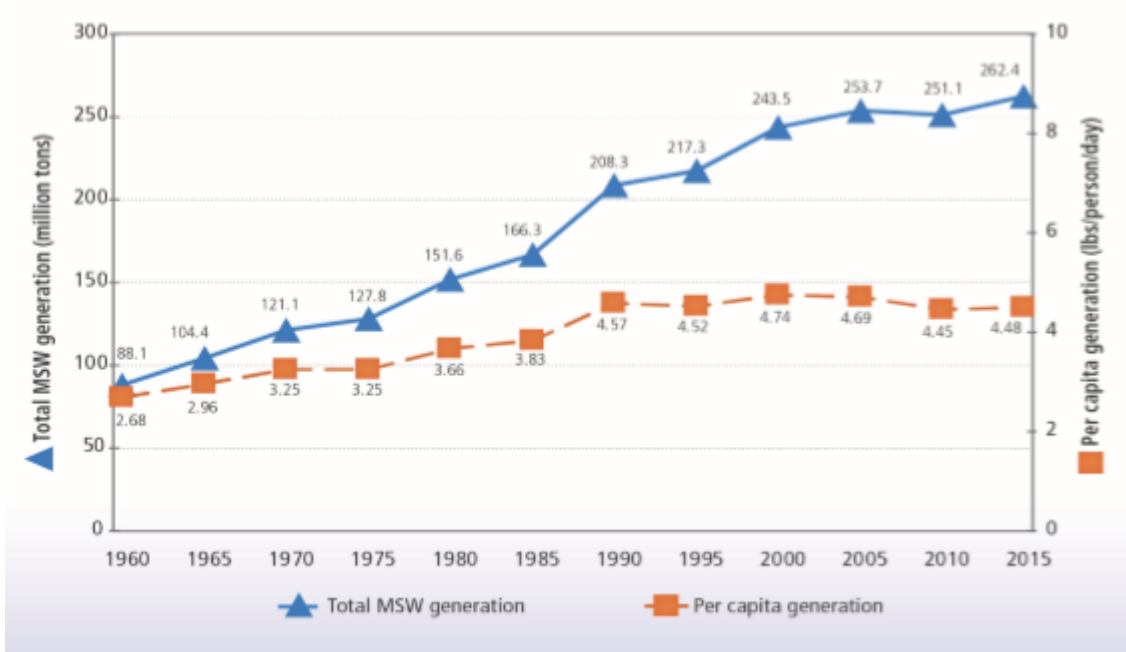
Figure 7.3: Household disposal of cell phones (e-waste), Canada, 2011 and 2013



Source: Statistics Canada (2017) *Canada at a Glance, Environment edition*, <https://www150.statcan.gc.ca/n1/pub/12-581-x/12-581-x2017001-eng.htm> (accessed 15 October 2018)

Shows disposal methods of household hazard waste and e-waste used by households.

Figure 7.4: USA Municipal Solid Waste (MSW) Generated 1960-2013



Source: US Environment Protection Agency (2018) *Advancing Sustainable Materials Management: 2015 Fact Sheet*, https://www.epa.gov/sites/production/files/2018-07/documents/2015_smm_msw_factsheet_07242018_fnl_508_002.pdf (accessed 17 October 2018)

Shows trend in municipal solid waste generated and generation per capita.

Figure 7.5: Waste materials by final treatment method, UK 2014

% proportion of waste material tonnages

Waste material	Energy recovery	Incineration	Recycling and other recovery	Backfilling	Deposit onto or into land (landfill)	Land treatment and release into water bodies	Total
Metallic wastes	0%	0%	100%	0%	0%	0%	100%
Glass wastes	0%	0%	96%	0%	4%	0%	100%
Paper & cardboard wastes	0%	0%	100%	0%	0%	0%	100%
Plastic wastes	0%	0%	97%	0%	3%	0%	100%
Wood wastes	24%	7%	65%	3%	1%	0%	100%
Vegetal wastes	0%	0%	98%	0%	2%	0%	100%
Household & similar wastes	0%	40%	7%	0%	53%	0%	100%
Mineral wastes	0%	0%	60%	2%	4%	34%	100%
Soils	0%	0%	18%	39%	43%	0%	100%
Dredging spoils	0%	0%	0%	0%	1%	99%	100%
Other wastes	5%	5%	27%	2%	61%	0%	100%
All wastes	1%	4%	44%	10%	23%	18%	100%

Source: Defra Statistics

'Energy recovery' refers to facilities where the main purpose is generation of energy, or formal R1 accreditation has been awarded

'Recycling and other recovery' refers to the Eurostat category 'Recovery other than energy recovery - Except backfilling'

Includes waste that may have been imported

'Other wastes' include residues following physical treatment and incineration of waste, residues from industrial processes and sewage

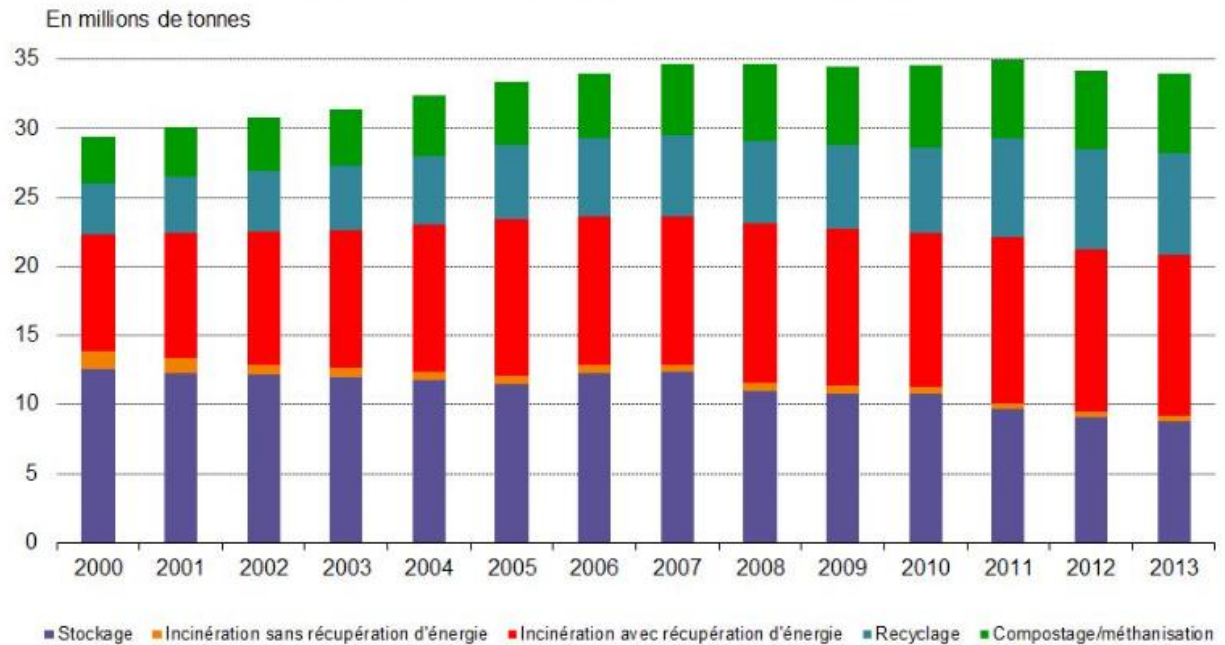
A more detailed material split is available in the accompanying dataset

Source: Department for Environment, Food and Rural Affairs (2018) *UK Statistics on Waste, 9th October 2018*

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/593040/UK_statsonwaste_statsnote_Dec2016_FINALv2_2.pdf (accessed 17 October 2018)

Shows the proportion of waste going to various treatment methods by waste material.

Figure 7.6: Trend in Municipal Waste Treatment in France (Évolution du traitement des déchets municipaux), 2000-2013



Champ : France entière, DOM inclus ; hors déblais et gravats.
 Source : Ademe. Traitements : SOeS, 2015

Translation: En millions de tonnes - millions of tons; Legend: Stockage – Landfilling, Incinération sans récupération d'énergie - Incineration without energy recovery, Incinération avec recuperation d'énergie - Incineration with energy recovery, Recyclage - Recycling, Compostage/méthanisation - Composting/methanisation

Source : Ministère de l'écologie, du développement durable et de l'énergie (2015) *Service de l'observation et des statistiques*: <http://www.statistiques.developpement-durable.gouv.fr/indicateurs-indices/f/2092/0/traitement-dechets-municipaux.html> (accessed 7 October 2018)

Shows the trend in treatment methods for municipal waste.

7B. SEEA accounts/tables that use these statistics⁷⁷

The SEEA physical flow accounts include flows from the environment into the economy (natural inputs), flows within the economy (products or residuals) and flows from the economy to the environment (residuals). Statistics on waste are included in flows of residuals, both within the economy and from the economy to the environment. For example, solid waste collected and stored in landfills is counted as a residual which remains within the economy.

The SEEA defines residuals as flows of solid, liquid and gaseous materials, and energy that are discarded, discharged or emitted by establishments and households through processes of production, consumption or accumulation. Flows of residuals into controlled and managed landfill, emission capture and storage facilities, treatment plants and other waste disposal sites are flows of residuals within the economy, rather than from the economy to the environment. Subsequent flows from these facilities may be either directly to the environment as residuals or lead to the creation of other products or residuals. Illegal dumping of waste is considered a flow from the economy to the environment. Flows of residuals are assigned to territories using the residence principle and are attributed to the country in which the emitting or discarding household or enterprise is resident.

Of the groups of residuals identified, FDES 2013 waste statistics covered by this methodology sheet, fall under the group 'solid waste' which is defined in the SEEA as discarded materials that are no longer required by the owner or user. Solid waste includes materials that are in a solid or liquid state but excludes wastewater and small particulate matter released into the environment. Note that traditional definitions of waste do not include the other groups of SEEA natural resource residuals.

Solid waste includes all materials sent to or collected by waste collection or treatment schemes including landfill establishments. Solid waste also includes those same materials if they are discarded directly to the environment, whether legally or illegally. In addition, solid waste may include some discarded materials exchanged between economic units, for example, scrap metal, for which the discarder receives payment. In these circumstances, the solid waste is considered a product (since the solid waste has a positive value) rather than a residual.

The SEEA accounts therefore require a disaggregation of waste recovered or recycled, as waste which the discarder receives payment for is considered a product in the accounts, while that which is treated and then recycled is a residual. Current waste statistics exclude waste recycled or recovered within industrial plants at the place of generation. However, waste exchanged between economic units is still counted as waste.

In the SEEA the physical supply table covers generation of solid waste, while the physical use table covers waste treatment – collection and disposal of solid waste residuals disaggregated by industry and households.

The supply-use tables include both treatment and pre-treatment activities such as mechanical-biological processes, and physical-chemical processes.

The SEEA supports the use of the Eurostat Material Flows Guidance for measurement of material flow accounts. The concept of material flow accounts (MFAs) is useful to understand resource use and reductions to waste in the circular

⁷⁷ United Nations, European Commission, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank (2014) *System of Environmental-Economic Accounting 2012: Central Framework*, Studies in Methods, Series F, No. 109. Sales No. E.12.XVII.12, https://unstats.un.org/unsd/envaccounting/seeaRev/SEEA_CF_Final_en.pdf (accessed 17 October 2018)

economy and for countries implementing the waste hierarchy.⁷⁸ This broader understanding is crucial in identifying prevention of waste and reduction of materials as inputs to production. MFAs cover both inputs into the economy, material accumulation in the economy and outputs. Accounts for physical inputs into an economy, at the highest level of aggregation, cover biomass, fossil fuels, metal ores, minerals; these are covered in FDES Component 2: Environmental Resources and their Use. For the most part, the statistics used are related to material resources, however, waste data on recycling and waste landfilled are also used to produce the accounts.

7C. Commonly used indicators that incorporate these statistics

The amount of **total waste and municipal waste collected or generated and treated**, presented in tonnes or per capita values over time, are commonly used indicators. They are composed of waste generated/collected in the numerator and the population served in the denominator. Additionally, the waste collected/produced disaggregated by the type of treatment (recycled, composted, incinerated, landfilled) is also used if available.

- **Waste intensity or waste productivity indicators**, combining waste generation with economic output, such as GDP and Value Added by economic activity, are currently developed at national and international level.

OECD Environmental and Green Growth Indicators: Waste generation intensity and recovery ratios⁷⁹

- Municipal waste generated per capita (kg/capita) = *amount of waste generated by waste category (3.3.1.b) / population*
- Municipal waste generated per unit of GDP or value added by sector = *amount of waste generated by waste category (3.3.1.b) / GDP*
- Percentage of municipal waste treated by recycling and composting, incineration with energy recovery, incineration without energy recovery and landfill = *amount of municipal waste treated by type of treatment and disposal (3.3.2.a.2) / total municipal waste generated (category of 3.3.1.b) x 100*

Eurostat Waste Management Indicators⁸⁰

Waste management indicators produced by Eurostat are used for monitoring the following indicator frameworks:

EU Resource Efficiency Scoreboard Indicators⁸¹

- Generation of waste (excluding major mineral wastes) = *total waste generated (derived from 3.3.1.a or 3.3.1.b) / population*
- Landfill rate of waste excluding major mineral wastes = *waste landfilled (landfill treatment type of (3.3.2.a.2+ 3.3.2.b.2+3.3.2.c.2) / (3.3.2.a.1 + 3.3.2.b.1+3.3.2.c.1) x 100*
- Recycling rate of municipal waste = *waste recycled (recycling treatment type of 3.3.2.a.2+3.3.2.b.2+3.3.2.c.2) / (3.3.2.a.1 +3.3.2.b.1+3.3.2.c.1) x 100*

⁷⁸ Eurostat (2001) *Economy-wide material flow accounts and derived indicators: a methodological guide*, Luxembourg, European Commission, <http://ec.europa.eu/eurostat/documents/1798247/6191533/3-Economy-wide-material-flow-accounts...-A-methodological-guide-2001-edition.pdf> (accessed 17 October 2018)

⁷⁹ OECD (2015) *Environment at a Glance 2015: OECD Indicators*, OECD, Paris <http://www.oecd.org/environment/indicators-modelling-outlooks/environment-at-a-glance-19964064.htm> (accessed 17 October 2018)

⁸⁰ Eurostat, *Waste management indicators*, http://ec.europa.eu/eurostat/statistics-explained/index.php/Waste_management_indicators (accessed 17 October 2018)

⁸¹ European Commission (2015) *EU Resource Efficiency Scoreboard 2015*, http://ec.europa.eu/environment/resource_efficiency/targets_indicators/scoreboard/pdf/EU%20Resource%20Efficiency%20Scoreboard%202015.pdf (accessed 17 October 2018)

- Recycling rate of e-waste = $\frac{\text{e-waste recycled (recycling treatment type for e-waste stream 3.3.2.a.2+3.3.2.b.2+3.3.2.c.2)}}{(3.3.2.a.1 + 3.3.2.b.1+3.3.2.c.1)} \times 100$

Eurostat Waste Statistics⁸²

- Municipal waste generated = *amount of waste generated by waste category (3.3.1.b), municipal waste*
- Municipal waste treated, by treatment method = *amount of municipal waste treated by type of treatment and disposal (3.3.2.a.2).*
- Generation of hazardous waste by economic activity = *amount of hazardous waste generated (3.3.1.c), by economic activity.*
- Percentage of waste managed, excluding major mineral waste, by waste treatment method = *(amount of waste⁸³ treated by type of treatment and disposal (3.3.2.a.2 + 3.3.2.b.2 + 3.3.2.c.2) - imports of waste (3.3.2.e) + exports of waste (3.3.2.f)) / (total waste generated (derived from 3.3.1.b) x 100* Note: The indicator shows how much national waste excluding major mineral waste is actually recycled, incinerated (with energy recovery and without), landfilled or backfilled. This means that the waste management indicator should reflect the treatment of national waste, no matter where it takes place, and it should exclude the waste that is imported.

7D. SDG indicators that incorporate these statistics

Indicator 11.6.1: Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities

The indicator is Tier II. The indicator measures the proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated. The statistics cover urban solid waste regularly collected and final discharge at city level.

Total solid waste regularly collected (3.3.2.a.1 + 3.3.2.b.1 + 3.3.2.c.1) / Total solid waste generated (3.3.1.a)
Of which adequately discharged is reported using qualitative criteria.

Indicator 12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment

The indicator is Tier III under development. Related FDES 2013 statistics are 3.3.1.c. Amount of hazardous waste generated and 3.3.2.b.2 Amount of hazardous waste treated by type of treatment and disposal.

Indicator Number 12.5.1 National recycling rate, tons of material recycled

The indicator is Tier III under development. Related statistics from the FDES 2013 are 3.3.2.d. Amount of waste recycled and Amount of waste generated (derived from 3.3.1.a or 3.3.1.b).

⁸² Eurostat Waste Statistics webpage, <https://ec.europa.eu/eurostat/web/waste> (accessed 17 October 2018)

⁸³ Eurostat webpage *Management of waste excluding major mineral waste, by waste operations* https://ec.europa.eu/eurostat/cache/metadata/en/env_wasoper_esms.htm (accessed 17 October 2018)



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