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NAMEA - Solid waste accounts

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NAMEA - SOLID WASTE ACCOUNTS

Summary: In this survey physical supply and use tables of residuals are compiled for 2003. The method used to compile these tables is based on a recently adopted procedure of data collection. This will ensure compilation of the tables for future years. In comparison to the waste accounts in the current NAMEA several improvements in the coverage of waste flows were made. The most important ones are: an increase in the number of waste types, a more detailed breakdown of the industrial classification, an extension with waste import and export and the incorporation of recycled waste. The physical database is good starting point for further extensions of the waste accounts.

Keywords: NAMEA, waste accounts, environmental accounting, supply and use tables.

Contents

1. Introduction

1.1 Objective and structure

Further development of the environmental accounts is considered important by Eurostat (Eurostat, 2003). One component of the Dutch environmental accounts that needs further development are the solid waste accounts. The aim of this paper is to set up waste accounts for 2003 that extend the current accounts on the following points: the number of waste types and industrial classification categories, incorporated import/export and recycled waste and a direct link between monetary and physical data. The newly developed waste accounts will become part of the yearly statistical output.

Chapter 1 gives a short introduction into the Dutch environmental accounts. Accounting principles relevant to the waste accounts will be discussed. In chapter 2 the state of the current Dutch waste accounts is discussed in more detail. Shortcomings of the current NAMEA are presented. Chapter 3 discusses developments on waste accounts frameworks suggested by others (Eurostat). Chapter 4 provides an overview of the data requirements of the extended waste accounts. This overview is provided in a format of supply and use tables. Chapter 5 gives an overview and discusses the usefulness of the available data sources for the waste accounts. In chapter 6 the available data is practically implemented. This results in physical supply and use tables of waste for the year 2003. Furthermore, a comparison between the current and the new waste accounts is made. In chapter 7, possible future developments are discussed. In chapter 8, definitions are given of the waste related terms discussed in this paper.

1.2 NAMEA

In the early nineties, the Dutch national accounts were extended by two environmental accounts: a substances account and an account for environmental themes (Keuning, 1993). These accounts present information on environmental pressure and are expressed in physical units. The integrated system of environmental and economic accounts was referred to as the NAMEA (National Accounting Matrix including Environmental Accounts) (de Haan and Keuning, 1996). The NAMEA-system yields consistent estimates for all conventional economic aggregates as well as for environmental indicators (CBS, 2005a). Importantly, this system enables a comparison between the contribution of all economic activities to conventional policy goals (GDP, exports, employment, etc.) and their contribution to major environmental problems (greenhouse effect, ozone layer depletion, acidification, etc.).

One substance account in the NAMEA considers solid waste. The solid waste account in the NAMEA mainly focuses on waste treatment and storage problems in the Netherlands. Solid waste may contribute to a range of environmental problems and therefore the composition of waste is usually very relevant. Other themes in the NAMEA may single out some of these 'quality aspects' of waste. For an extended overview of integrated environmental and economic accounting see the thesis by de Haan (2004) and the handbook on Integrated Environmental and Economic Accounting (SEEA, Commission of the European Communities et al., 2003)

1.3 Waste accounting principles

1.3.1 Economic – environment boundary

The solid waste account of the NAMEA follows an accounting scheme that maintains a strict division between the economy and the environment. The NAMEA primarily focuses on the material transfers that take place from the economic system to the natural environment. Waste flows associated with monetary commodity transactions do not enter the NAMEA substances account. From an environmental perspective, the NAMEA systematically exposes the national accounts system's boundaries and the physical substance flow accounts logically expand these boundaries. In the SEEA (Commission of the European Communities et al., 2003) the economy/environment interface is discussed more extensively.

In the environmental accounts both the pollution generated by economic activities and the accumulation of hazardous substances in the Dutch environment are incorporated. The accumulation is equal to the domestic generation of pollutants, minus their absorption by environmental treatment services (e.g. waste incineration) and minus the balance of trans-boundary pollutant flows to and from other countries. Internally recycled waste is by convention not included in the NAMEA.

A conceptually correct recording of solid waste would be to include waste stored on human controlled landfills (similarly as incinerated waste) as a re-absorption of waste by the sewage and refuse disposal services industries. The consequence of this recording would be that emissions from landfills should be attributed to the corresponding waste management industry since this recording defines landfills as a stock of residuals controlled within the economic sphere. Only the uncontrolled dumping of waste would be reflected in the NAMEA indicator. Currently, the Dutch NAMEA does not distinquish between direct waste discharges to the environmental and storage of waste in controlled landfills. The current waste indicator in the NAMEA reflects the annual amount of waste that has to be stored regardless its precise destination.

Although, according to the above reasoning, leakages from landfill sites must be regarded as flows within the environment, the Dutch NAMEA records these leakages (e.g. methane, CH_4), as economic-environmental material transfers. This minor inconsistency is introduced on practical grounds (see de Haan, 2004). Firstly, the reduction of solid waste storage in landfills has been a specifically addressed policy goal in the Netherlands, and it seems for that reason relevant to explicitly address the accumulation of waste on landfills in the environmental performance indicators of the NAMEA. Secondly, it should be acknowledged that emissions from landfills are part of the human induced environmental burdens which can be considerable.

1.3.2 Waste products versus residuals

The demarcation between the economy and the environment is accompanied by a sub-categorization of waste with and without an economic value. Waste with an economic value to the generator is considered a waste product and has a monetary equivalent in the national accounts. Waste with no market value to the generator is considered a residual and appears in the substance account. Like products, residuals may be transferred within the economy as a result of recycling or waste collection and treatment activities. Monetary transactions as a result of waste treatment services are recorded in the national accounts. Waste treatment usually results in the replacement or transformation of residuals with the purpose of diminishing their environmental impacts. Those residuals that are not re-absorbed by the economy will be transferred from the economy into the natural environment.

Flows of residuals from the environment to the economy can also occur. For example, tankers at sea may lose their cargo in a storm. Efforts might then be made to recover these residuals from the environment and bring them back into the economy for treatment. For a more profound discussion on the compilation of harmonious monetary and physical supply and use tables see the SEEA (Commission of the European Communities *et al.,* 2003).

1.3.3 The resident principle

Data on solid waste are derived from so-called waste inventories. The application of pollution sources in order to establish waste emissions usually differs in these inventories from those in the national accounts. Emission inventories often include emission sources within the boundary of a country while a national accounts-based demarcation of emission sources can only be established on the basis of the resident principle i.e. all agents that take part in an economy of a country whether operating within the national territory or abroad. The resident principle guarantees that macroeconomic indicators such as Domestic Product and National Income are comparable between countries and can be added straightforwardly over countries. The resident principle is therefore also important in the recording of waste generated by an economy.

Connecting physical waste flow data from inventories to national accounts data will result in modification of the original emission data. In order for the environmental consequences of these activities to be taken into account in the NAMEA, it is necessary to add waste emissions by residents in the rest of the world and deduct emissions by non-residents in the Netherlands.

Consistency between physical flow accounts and the national accounts guarantees not only a consistent comparison of environmental burdens to economic benefits (or environmental benefits to economic costs) but also a consistent demarcation of the environmental burdens of the economic systems of individual countries.

2. Solid waste accounts in the Dutch NAMEA: Current state

2.1 Solid waste accounts

Throughout this report terms are used that can be subject to ambiguous interpretations. For clarity sake, the terms as they are used in this paper are defined in chapter 8. Definitions are derived from several sources but from EIONET (www.waste.eionet.eu.int/definitions/waste). EIONET is a collaborative network of the European Environment Agency and its member countries.

The waste accounts in the current NAMEA are restricted to those waste flows directly resulting from either production or consumption activities. Dissipative use of products and dissipative losses are beyond the scope of the current waste accounts. These outputs refer to uses of products on agricultural land (e.g. pesticides), on roads (salt) and for other purposes, and to dissipative losses by erosion and corrosion of infrastructures, by abrasion of car tires, brake discs and engine leakages. Also not included in the current NAMEA waste accounts are movement of matter i.e. excavations and material movements in mining and construction operations. Including these material movements would expand the notion of waste enormously.

Data on solid waste generation in the current NAMEA corresponds to a large extent to net generated waste – i.e. gross generated waste minus waste re-absorbed into the economic sphere, *e.g.* recovered or treated waste. This implies that only wastes (residuals) transferred to the natural environment (including disposal on landfill sites or elsewhere) are recorded. An exception to the net presentation of data is the amount of incinerated waste. Waste with the purpose of being incinerated is recorded as output by the economic sphere. This includes both internally (within the establishment) and externally incinerated waste. In turn, the amount of waste incinerated by waste incinerators (NACE[1] 90) is recorded as re-absorption into to the economic sphere. Wastes incinerated by other branches of industry are not recorded as re-absorption. Thus, the solid waste indicator in the current NAMEA addresses the total amount of waste that has to be stored regardless of its precise destination plus the amount of waste not incinerated by NACE 90.

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[1] European industrial classification: Nomenclature d’Activité dans la Communauté Européenne. The Dutch classification (SBI 1993) is on 4-digit level similar to the NACE.

Waste destined to be recycled is excluded from the total waste supply of waste generators. In turn, the amount of recycled waste is not recorded as re-absorption. Recycled waste is not explicitly included in the NAMEA because the destination (type of industry) was not known. Another reason for not including recycled waste is that no distinction could be made between recycled waste with (waste products) and without (residuals) an economic value. As discussed in section 1.3.2, waste products should be excluded from the emissions and re-absorptions in the NAMEA-substance accounts.

In the National accounts (CBS, 2005a) the origin and destination of solid waste destined for final treatment (disposal or incineration) are presented. Waste emissions of consumers and almost 40 industrial categories are distinguished. Absorption of incinerated waste by NACE 90 and the contribution to environmental waste indicator is presented. Cross-boundary flows of waste are not presented in the current NAMEA. No distinction is made between different waste types. The following section gives a detailed description of the compilation of the current waste accounts.

2.2 Waste categories and economic activities

Apart from waste from industrial processes (CBS, 2005b), communal sewage sludge (CBS, 2005c) and hazardous waste (Meurs, 2002), data on the amount of waste produced in the Netherlands are taken from the Milieucompendium (i.e. Dutch Environmental Data Compendium; RIVM *et al.*, 2004). Data in the Milieucompendium (MC) are, in turn, composed of data from a.o. Statistics Netherlands (CBS), AOO (Afval Overleg Orgaan – i.e. Waste Management Council) and ITM-research. Recently the AOO and work on waste by the LMA (Landelijk Meldpunt Afvalstoffen – i.e. National Registration center of hazardous Wastes) are incorporated by SenterNovem. SenterNovem is an agency of the Dutch Ministry of Economic Affairs for implementing policies on innovation, energy, climate and environment and spatial planning.

Around 15 different types of waste are considered in the current NAMEA. For some of them, the total amount was allocated to a unique economic category. Other waste categories were split between industries. This section describes waste categories allocated to economic activities.

Household waste, bulky waste and waste from municipal scavenging departments are allocated to household consumption. Waste incinerated by households themselves is not taken into account. Data are obtained from the MC.

The total amount of **waste from retail trade, offices and services** is taken from the MC. Allocation of waste to different economic activities takes place in two steps. On the basis of an ITM survey (ITM, 2002) a crude allocation to NACE is made. Subsequently the value added shares are used for a more refined allocation to NACE: 50, 51 (excl. 5157), 5157, 52+55, 60, 61, 62, 63, 64-67+70-74, 75, 80, 85, 90 and 91-93+95. In principle **non-hazardous slag from waste incineration** is included in the data. However, the way in which the survey is conducted (small sample survey) makes it improbably that the data contains slag.

The total amount (in dry matter) of incinerated and disposed **Sewage sludge (communal)** is allocated to NACE 90 (sewage and refuse disposal services). Data are obtained from Statline (CBS, 2005c).

Car wrecks and Tires are allocated to consumers (67%) and to NACE 60 (land transport – 33%). Percentages are based on an expert guess. The total amount is relative small and taken from the MC.

Construction and demolition waste is allocated to NACE 45 (construction). Data are obtained from the MC.

Agricultural waste is allocated to NACE 1 that comprises horticultural and forestry as well. Data are obtained from the MC.

On the basis an expert guess, **waste from ships** is allocated to consumer transport, fishery (NACE 5) and water transport (NACE 61). Data are obtained from the MC.

The source of data on **waste from industrial processes** (NACE 10+14, 11, 15+16, 17+18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30-33, 34+35, 36 and 37) is provided by statistics on companies' waste material published on Statline (CBS, 2005b). Data on Statline are based on a biennial Statistics Netherlands survey and annual environment reports of large companies. Waste from industrial processes includes sludge from waste water purification plants and exclusive externally processed hazardous waste. From 2001 onwards, waste from companies employing fewer than 10 people is also included in the data.

Phosphogypsum arises from production of chemical fertilizers and was therefore allocated to the chemical industry (NACE 24). The amount of phosphogypsum is determined separately because it is not included in the data on waste from industrial processes. From 2001 onwards phosphogypsum is no longer produced.

Waste from electricity, gas and water suppliers is allocated to NACE 40 and 41. Data are obtained from the MC. **Coal slag from electricity plants** is included in the data. However, coal slag does not appear in the NAMEA because all of it is re-used.

The Statline publication by Statistics Netherlands on **externally processed hazardous waste** categorized by industry was terminated in 1997. The reason for this was that industries were obliged to report discharges of hazardous waste to the LMA (from 2004 onwards monitoring is taken over by SenterNovem). From 1997 onwards, the LMA composes figures on hazardous waste. Data of the LMA monitoring are published in the MC. Until 2001 data from the MC were used in the NAMEA. In the MC the amount of waste is not allocated to economic activities. Allocation to economic activities takes place on the basis of external reports (o.a. VROM, 2002) and the value added shares. From 2002 onwards, LMA-data on hazardous waste categorized by industry were used. To determine the amount of incinerated and disposed waste, a percentage of the total amount was taken. It is not exactly clear how this percentage was determined. The amount of externally processed waste is added to the total amount of non-hazardous waste. Notice that **hazardous slag from waste incineration** is also included. **Internally final treated (not recycled) hazardous waste** is included in the data on industrial processes.

Contaminated soil, dredging sludge and manure are currently excluded from the waste accounts. The generation of contaminated soil was not included because of methodological difficulties in allocating the pollution to a specific year. Examples are contaminated soil at a factory site or contaminated soil at a petrol station. However, light contaminated soil (for example as a result of a spill) that is cleaned up straight away is included in the data. Dredging sludge (of canals or harbors) and manure were considered beyond the scope of the NAMEA waste accounts. Small amounts of dredging sludge from companies are included in the data.

2.3 Shortcoming of the current NAMEA waste accounts

From the above sections a few shortcomings of the current NAMEA waste accounts can be determined. This section gives an overview of these shortcomings. In chapter 4 the data needed to overcome these shortcomings is presented.

- Although the current NAMEA waste accounts distinguish around 40 industrial categories, it does not meet the classification required for the NAMEA 2004 publication.

- Although in the current waste accounts some distinction between waste types can be made, elaborate reporting of different waste types has not taken place.
- Currently, the waste accounts do not incorporate im- and export of waste. To be able to construct complete waste accounts, cross-boundary flows are essential.
- In the current waste accounts only incinerated and landfill waste are considered. For complete waste accounts recycled residuals should are also be considered.
- In the current waste accounts a direct link between the physical and monetary data is not made explicitly.
- The amount of waste incinerated by incineration plants is taken as the total amount of absorption in the current NAMEA. For a complete picture, absorption should be determined by the total amount of residuals returning to the economy.

3. Further development

This chapter discusses the interest of a few institutes for further development of the NAMEA waste accounts. Desires of Eurostat and Dutch institutes like the RIVM (Rijksinstituut voor Volksgezondheid en Milieu – i.e. National Institute for Public Health and the Environment) and SenterNovem are considered.

3.1 Eurostat

A joint Eurostat/EFTA group meeting resulted in a paper on the development of waste accounts for the NAMEA (Pasquier, 2003). Eurostat's proposal for the development of waste accounts for NAMEA is based on the Waste Statistics Regulation (WStatR; European Communities, 2002). The waste categories (according to eural codes), waste treatment methods and the NACE-based economic classification defined within the WStatR, serve as baseline for developing the NAMEA waste accounts.

In order to make the filling of the framework feasible Eurostat proposes not to include too detailed data in the waste accounts. Eurostat proposes twelve waste categories that are compatible with the WstatR (the WStatR does not cover radioactive waste (4)).

- Compound waste (01)
- Chemical preparation waste (02)
- Other chemical waste (03)
- Health care and biological wastes (05)
- Metallic wastes (06)
- Non-metallic waste (07)
- Discarded equipment (08)
- Animal and vegetable wastes (09)
- Mixed ordinary waste (10)
- Common sludge (11)
- Mineral waste (12)
- Solidified, stabilized and vitrified wastes (13)

In the WStatR, section 2 of Annex I specifies within these categories another 48 waste categories according to which data should be reported to Eurostat. This section also indicates for which waste category a distinction between hazardous and non-hazardous waste must be reported.

The Eurostat paper on the development of waste accounts for NAMEA proposes a distinction between internal (i.e. for own account) and external waste treatment (i.e. by another enterprise of which it is the principal or secondary activity). Concerning external treatment, a distinction between incineration, recycling and disposal is proposed. Data on internal waste treatment should be split between incineration and disposal. Internal recycling should not be taken into account since internal recycling and reuse is excluded from the WStatR. For both external and internal incineration, data may be split between incineration with or without energy recovery because of the difference between either of these waste treatment modes in environmental terms.

Table 3.1 gives a schematic description of what NAMEA waste accounts could look like according to Eurostat. It is presented here for aggregated waste categories. Notice that the waste treatment classification in table 3.1 differs slightly from the table published by Pasquier (Pasquier, 2003). In order to link up waste definition used throughout this report, in table 3.1 a distinction is made between incineration with (R1) and without (D10) the purpose of generating energy. As a result of this distinction the term recovery was replaced by the term recycling.

		Aggregated waste categories															
		Tonnage								Expenditure							
		Generation	External treatment				Internal treatment			External treatment				Internal treatment			
			Incineration				Incineration			Incineration				Incineration			
			R1	D10	Recycling	Disposal	R1	D10	Disposal	R1	D10	Recycling	Disposal	R1	D10	Disposal	
Industries	NACE																
	01-02																
	05																
	10-14																
	15-16																
	17-19																
	20																
	21-22																
	23																
	24-25																
	26																
	27-28																
	29-35																
	36																
	37																
	40-41																
	45																
	50-99																
	51.57																
	90																
	households																

R1: Use principally as a fuel or other means to generate energy.
D10: Incineration on land.

Table 3.1: Schematic waste accounts for NAMEA according to Eurostat (adapted from Pasquier, 2003)

3.2 Others

The RIVM has delegated research on waste to SenterNovem. The waste accounts are of interest to SenterNovem if data analyses would provide information on factors explaining changes in waste flows. Also, SenterNovem is interested in the environmental expenditure on waste treatment for different establishments.

The Ministry of Housing Spatial Planning and the Environment (VROM) have an interested in the waste accounts if they provide information on the relation between environmental pressure and waste production/treatment.

4. Overview of desired data

This chapter will give an overview of the data that is needed to compile waste accounts that overcome the shortcomings of the waste accounts pointed out in chapter 2 and satisfy the interest of further development as discussed in chapter 3. The desired data will be presented as supply and use tables. First of all the information that should appear in the new waste accounts is summarized:

1. An extension of the number of waste categories. The classification of waste categories should be according to the WStatR. In annex 1 the distinguished waste categories are presented.
2. NACE classification in accordance with the standard NAMEA classification. In annex 2 the distinguished industrial categories are presented.
3. A distinction between waste products and residuals.
4. Waste import and export.
5. Internally and externally treated waste.
6. Besides land filled waste and incinerated waste (with and without energy recovery), recycled waste should be incorporated.
7. An explicit link between physical and monetary data. For example, disposal fees, expenditure, taxes and subsidies should be presented in relation to physical waste flows.
8. Include all residuals absorbed by the economy

4.1 Supply and use tables

It is very important to set up the waste accounts in a way they can easily be incorporated in the framework of the NAMEA. Therefore data on waste is presented in the format of supply and use tables.

Supply and use tables show the production and consumption of goods and services by an economy. They are usually measured in monetary terms. In the supply table the domestic production of commodity groups by industries is given, as well as the imports of those goods and services. In the corresponding use table the use of the same commodities by industries is given. The use table also shows the final demand for those goods and services (consisting of exports, consumption by households and government, gross fixed capital formation and changes in stocks) and the value added of industries (wages, social changes, indirect taxes and operating surplus) See, for example, CBS (2005a) for a more detailed explanation of the system of supply and use tables.

The supply and use tables show an integral picture of the flows of commodities through the economy whereby in principle every product, every producer and every consumer is taken into account. That makes this system a convenient starting point for the compilation of physical accounts. The supply and use tables fulfill a main identity, which plays an important role in compiling the tables. The identity holds for each commodity group (i.e. for each row of the supply and use tables):

1) total supply = total use

or in more detail, for each commodity group of interest holds:

2) output of industries + imports =

   inputs of industries + exports +consumption by households and government + fixed capital formation + changes in stocks.

The monetary supply and use tables presented in tables 4.2 and 4.3 emphasize the commodities relevant from the point of view of waste products. The physical supply and use tables can be compiled in a similar way and are presented in tables 4.4 and 4.5. Waste products in the physical tables have a match in the monetary tables. Physical supply and use tables of residuals are an extension from the tables containing the waste products. The physical entities of residuals are included in the substances account. Often residuals have a negative economic value: producers have to pay a price to get rid of their waste. This monetary transaction is recorded as a waste treatment service in the national accounts system.

The purpose of these tables presented here is to indicate what cells need to be filled in order to satisfy the interest in waste data. Therefore only a limited number of entries are presented. No distinction is made between waste types and only a few NACE categories are distinguished (for complete lists see Annex 1 and 2). Entries that concern waste products or residuals are presented extensively.

4.2 Monetary supply table

The monetary supply table (table 4.2) shows waste products with an economic value and services that involve either monetary transfers between establishments or expenditure for internal treatment of residuals. Goods and services are supplied by industry and government. Monetary transfers from the ROW show as import of waste products. Also, waste products produced by non-residents in the Netherlands are considered a supply from ROW. Taxes and subsidies on products are presented by additional rows and columns. No distinction is made whether or not a tax is earmarked for environmental (financing) purposes. Taxes and subsidies are shown separately. Trade margins occur at, for example, recuperation services in waste and scrap (wholesaler). Under national accounts conventions, wholesalers are not shown as acquiring and disposing of goods but only of adding a trade margin.

MONETARY SUPPLY TABLE		Domestic production Industries						ROW		Environmental taxes and subsidies		Other taxes and subsidies		Transport and trade margins	
		Agriculture, fishing and mining	Manufacturing, electricity and construction	Recycling	wholesale incl. trade waste and scrap	Environmental services	Other services	Import	non-residents in NL	Tax on products/residuals + import	Subsidies on products/residuals + import	Tax on products + import	Subsidies on products + import		Total supply
Goods and services	Waste products														
	Other products														
	Waste incineration services														
	Waste disposal services														
	Waste recovery services														
	Internal incineration services														
	Internal disposal services														
	Other internal environmental services														
	Other services														

Table 4.2: Monetary table on waste supply

4.3 Monetary use table

The use table (table 4.3) includes columns for intermediate consumption (including expenditure for internal treatment), final consumption, gross fixed capital formation, export and residents abroad. Intermediate consumption represents the value of goods and services used in production while final consumption is supposed to satisfy direct individual or public needs. Taxes and subsidies on production are presented in additional rows. Capital formation occurs when industries purchase waste products for making other goods and services in future periods. Monetary transfers to the ROW show as the export of waste products and the value of waste products produced by residents in the ROW.

		Intermediate consumption						Final consumption							
MONETARY USE TABLE		Industries						Consumption household + government			Capital		ROW		
		Agriculture, fishing and mining	Manufacturing, electricity and construction	Recycling	wholesale incl. trade waste and scrap	Environmental services	Other services	Government	Own account transport	Other consumption	Capital formation	inventory	Export	Residents in ROW	Total use
Goods and services	Waste products														
	Other products														
	Waste incineration services														
	Waste disposal services														
	Waste recovery services														
	Internal incineration services														
	Internal disposal services														
	Other internal environmental services														
	Other services														
Primary inputs	Environmental tax on production														
	Environmental subsidies on production														
	Other tax on production														
	Other subsidies on production														
	Income														
	Other income														

Table 4.3: Monetary table on waste use

4.4 Physical supply table

The physical supply (table 4.4) table consists of two parts. The upper part is concerned with waste products and matches the monetary supply table (within the economic sphere). The lower part is concerned with residuals and represents the substance accounts (within the environmental sphere).

Domestic production of goods by industries and government result in waste products and residuals. Consumption of households by convention does not result in (waste) products. It does, however, result in a supply of residuals. Disposal of capital and other durable items acquired in earlier periods results in residuals. Waste products and residuals can be imported from the rest of the world (ROW) for treatment in the Netherlands. Also, waste produced by non-residents in the Netherlands is considered as a supply from ROW.

Due to environmental clean-up activities solid waste can re-enter the economic sphere. This may be the case for cleaning of contaminated soil, cleaning up oil spills and so on. In this case, in the accounts the national environment is considered to supply residuals. Although inconsistent with NA concept landfill sites are considered part of the national environment.

		Domestic production																
PHYSICAL SUPPLY TABLE		Industries						Consumption household		Capital	ROW			National Environment		
		Agriculture, fishing and mining	Manufacturing, electricity and construction	Recycling	wholesale trade waste and scrap	Environmental services	Other services	Own account transport	Other consumption	Capital formation	Import	non-residents in NL	Inflows from ROW environment		inventory - landfill sites	Total supply
Goods and services	Waste products															
	Other products															
Residuals	Incineration (to extern)															
	Disposal (to extern)															
	Recovery															
	Incineration (to intern)															
	Disposal (to intern)															
	Other residuals															

Table 4.4: Physical table on waste supply.

4.5 Physical use table

In table 4.5 waste products and residuals are used by industries and the government in the course of making other goods and services (intermediate consumption). Residuals used for disposal can be considered waste destined to for land fills. These residuals are considered to end up in the environment.

		Intermediate consumption						Final consumption							
PHYSICAL USE TABLE		Industries						Consumption household + government		Capital	ROW		National Environment		
		Agriculture, fishing and mining	Manufacturing, electricity and construction	Recycling	wholesale trade waste and scrap	Environmental services	Other services	Own account transport	Other consumption	Capital formation	Export	Residents in ROW		inventory - landfill sites	Total use
Goods and services	Waste products														
	Other products														
Residuals	Incineration (to extern)														
	Disposal (to extern)														
	Recovery														
	Incineration (to intern)														
	Disposal (to intern)														
	Other residuals														

Table 4.5: Physical table on waste use

5. Data Availability

Physical and monetary data are available from different sources. One mayor source is Statistics Netherlands, another one SenterNovem. The following chapters give an overview of the availability and usefulness of data from respectively Statistics Netherlands, SenterNovem and the WAR (Werkgroep Afvalregistratie – i.e. working party on waste registration). Data from SenterNovem are only discussed when not derived from Statistics Netherlands data. SenterNovem manages a database that contains physical data on waste flows from different sources. The database contains data from 2002 onwards. In section 5.4 this database is discussed extensively.

Below the usefulness of each data source, to estimate waste flows for 2003, is discussed. Some sources may be complementary to one another. Also, where appropriate, remarks are made on the usefulness of the data source to compile time series.

Chapter 5 sums up with an overview of all available sources from which conclusions are drawn considering the usefulness of the data in order to fulfill the needs discussed in chapter 4. From these conclusions a recommendation is given on the practical implementation of the data into the waste accounts. The results of this implementation are given in chapter 6.

5.1 Statistics Netherlands

5.1.1 National Accounts data

The supply and use tables of the national accounts (NA) provide data on waste that involve monetary transactions. The following goods and services can be distinguished:

- Waste products: ferro, non-ferro, aluminum, precious metal, copper, plastic, glass, furnace slag, paper and rubber.
- Recycled products: scrap ship, ferro, non-ferro, glass, wood, plastic, rubber and stone.
- Second-hand products: military equipment, tires, machinery, airplanes, clothes, cars, fissional material nuclear reactors, ships and lorries.
- Environmental services: collection and processing of waste and wastewater. A distinction is made between services conducted by the government and individuals.

The following aspects of these goods and services are provided in the supply and use tables:

- consumers (intermediate consumption, government and households), producers (NA classification), import, export, capital formation, margins, taxes and subsidies.

Tables 5.1.1a and 5.1.1b present the supply and use of waste products and recycled products. Second-hand products and services are not taken into account. Second-hand products are products that are being re-used in their original form. They are neither products that are discarded by the supplier nor products that are derived from waste products. Considering the waste accounts they are not of very much interest. Environmental services are not included because it is not clear to what degree they relate to solid waste. Statistics on environmental services by Statistics Netherlands (discussed below) might provide more useful data. However, the NA data may be useful in allocating the environmental services to different users.

With respect to the producers, table 5.1.1a shows the highest supply of waste products from the recuperation industry and the highest supply of recycled products from the recycling industry. The import of waste products also accounts for a large amount in the supply table.

		Waste products										Recycled waste products						
Indus. Clas	Description	Other non-ferro	Plastic	Aluminium	Ferro	Copper	Precious metals	Glass	Furnace slag	Paper	Rubber	Other non-ferro	Ferro	Glass	Wood	Plastic	Rubber	Stone
10, 14	Other mining and quarrying	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0
17, 18, 19	Manufacture of textile and leather products	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	Manufacture of paper and paper products	0	0	0	0	0	0	0	0	39	0	0	0	0	0	0	0	0
22	Publishing and printing	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
24.1	Manufacture of basic chemicals	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacture of fabricated chemical products	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	Manufacture of rubber and plastic products	0	9	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
27	Manufacture of basic metals	6	0	3	4	0	0	0	7	0	0	0	0	0	0	0	0	0
28	Manufacture of fabricated metal products	0	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0
29	Manufacture of machinery n.e.c.	1	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
30-33	Manufacture of electrical equipment	1	0	0	0	7	0	0	0	0	0	0	1	0	0	0	0	0
34, 35	Manufacture of transport equipment	0	0	19	2	0	0	0	0	0	0	0	0	0	0	0	0	0
36	Other manufacturing n.e.c.	0	1	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
37	Recycling industries	0	0	0	0	0	22	0	0	0	0	76	113	24	4	78	24	57
4525, 453 - 455	Building installation and completion	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0
5157	Wholesale trade recuperation	22	0	32	317	117	108	27	0	235	0	0	0	0	0	0	0	0
80	Subsidized education	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
90	Sewage and refuse disposal services	0	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0
	Import	44	49	213	381	77	223	9	11	157	9	0	0	0	0	0	0	0
	Trade margins	0	3	8	28	6	5	0	1	0	2	0	0	0	0	0	0	0
	Transport margins	0	0	0	0	0	3	1	0	56	0	5	5	1	0	3	1	0
	Taxes and subsidies on products	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5.1.1a: Monetary supply table of waste products and recycled waste.

The high values for recuperation (NACE 51.57, wholesale trade in waste and scrap) are somewhat suspicious. The activity of NACE 51.57 is restricted to waste storage, sorting etc. and is one where goods are sold in the same condition in which they are acquired without undergoing any physical transformation other than sorting, and packaging. Under national accounts conventions, wholesalers are not shown as acquiring and disposing of goods but only of adding a trade margin. The goods are shown as going directly from the producer to the user and do not feature as intermediate consumption of the wholesaler. However, the NA shows quite some production of waste products by NACE 51.57. The reason for this is that NACE 51.57 acquires residuals and subsequently sells waste products. Because residuals do not have an economic value, the first time they appear in the NA at the supply side of NACE 51.57 (at which point the residuals have become waste products).

Table 5.1.1b shows the use of waste products and recycled products by industries. No apparent anomalies can be observed. A large amount of waste products are exported.

		Waste products										Recycled waste products						
		Other non-ferro	Plastic	Aluminium	Ferro	Copper	Precious metals	Glass	Furnace slag	Paper	Rubber	Other non-ferro	Ferro	Glass	Wood	Plastic	Rubber	Stone
Indus. Clas.	Description																	
17, 18, 19	Manufacture of textile and leather products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
21	Manufacture of paper and paper products	0	0	0	0	0	0	0	0	242	0	0	0	0	0	0	0	0
24.1	Manufacture of basic chemicals	0	0	0	0	0	9	0	0	0	0	0	0	0	0	23	0	0
242-247	Manufacture of fabricated chemical products	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0
25	Manufacture of rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	20	0
27	Manufacture of basic metals	15	0	108	26	68	0	0	0	0	0	61	64	0	0	0	0	0
28	Manufacture of fabricated metal products	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
29	Manufacture of machinery n.e.c.	0	0	0	3	0	0	0	0	0	0	0	44	0	0	0	0	0
30-33	Manufacture of electrical equipment	0	0	0	0	7	48	0	0	0	0	0	0	0	0	0	0	0
20	Manufacture wood and wood products	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
26	Manufacturing other non-metalic mineral products (construction materials)	0	0	0	0	0	0	19	21	0	0	0	0	28	0	0	1	2
36	Other manufacturing n.e.c.	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	0	0
37	Recycling industries	2	38	2	93	13	21	14	1	0	6	0	0	0	0	0	0	0
4521.1, 4521.3, 4522	Construction of buildings	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	4
4521.2, 4523, 4524	Civil engineering	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	57
4525, 453-455	Building installation and completion	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
75	Public administration and social security	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0
	Export	22	27	35	321	104	128	1	1	164	2	26	10	2	0	16	4	0
	Export-transit	35	27	130	349	26	88	3	2	93	6	0	0	0	0	0	0	0
	Capital formation	0	0	0	0	0	18	0	0	0	0	-6	0	-5	1	0	0	-6

Table 5.1.1b: Monetary use table of waste products and recycled waste

For the NAMEA waste accounts it is important to distinguish between waste products and residuals. NA data are only concerned with waste products (not residuals). Only environmental services paid to dispose of residuals appear in the NA. However, those services are not linked to specific materials. Data on physical waste flows does not make a distinction between waste products and residuals. In theory the monetary NA may be used as a tool to make a distinction in the physical data between waste products and residuals. In this way the amount of residuals in relation to the treatment expenditure can be shown. In order to make this differentiation, the monetary NA data has to be converted into physical data. Unit values (euro/kg) of different waste products could be used for such a conversion. Unfortunately it turns out to be problematic to come up with consistent unit values for waste products. Prices of for example glass or paper may fluctuate very much during the year or across region. Also, according to NA experts great care should be taken when using detailed NA data because many data are based on assumptions and estimations.

Also, a closer look at the NA shows that the waste categories are an aggregate of heterogeneous sub-categories. A single unit value can not be assumed for these sub-categories. This makes converting the monetary data into physical data by using unit values even more tricky. Therefore, it is doubtful if the NA data can act as a reliable source to distinguish waste products from residuals. However, it may be assumed from the NA data that the monetary distribution of the waste products across the NACE categories must be similar as for the physical data. If this assumption is valid the monetary data can be used to allocate the physical data to NACE categories.

In conclusion:

- Monetary data from the NA can in potential be converted to physical waste products. As a consequence the NA can be used as a tool to distinguish residuals from waste products in physical terms. Unfortunately, the reliability of the results after conversion is in doubt. However, the monetary data might still be useful as a tool to allocate physical waste flows to NACE categories.

5.1.2 ProdCom statistics

Prodcom statistics are based on European regulation Nr.3924/'91. It contains data on industrial production (NACE 10-41, no data on NACE 37) for several products. These products are specified for each NACE and can be found in the ProdCom list. The 6000 companies (with 20 or more employees) in the sample survey have to report the physical amount and value of produced products. On Statline, the statistics on Sales of industrial products (CBS, 2005d) shows the Prodcom data. The amounts and values of all products are shown for the total industry. A few waste types can be distinguished in the product list: slag, glass, ferro, cork, silk, offal, oil and fats, wood, fiber from starch industry, from sugar industry and from the brewery industry. Other waste types are taken together with products and can not be singled out. Unfortunately, for most of the distinguished waste types there seems to be a lack of data. Data are only found for offal, wood, from starch industry and from the brewery industry. Also, some NA specialists doubt the quality of the ProdCom data.

In conclusion:

- This data source does not seem to provide very useful data. Only for a few waste types useful data can be obtained.

- ProdCom data is only concerned with waste products.

5.1.3 Foreign Trade Statistics (FTS)

Statistics Netherlands collects data on import and export of products including waste products. Data are obtained by conducting a survey under companies and from custom registrations. Both monetary and physical information is registered. After data collection, Statistics Netherlands adjusts the data for non-responds, reporting thresholds (only companies that trade over 400.000 euros a year must report to Statistics Netherlands) and inaccuracies to represent the total import and export. Finally, Foreign Trade Statistics (FTS) data are implemented in the national accounts (NA) by adjusting the monetary data. At this point the physical data are not given much consideration. Therefore, the FTS data seem most useful in the stage before implementation in the NA.

Waste products can appear as a fraction of aggregated commodities that are in themselves not waste products. For example, some “Vegetal waste of food preparation and products” (eural code 9.12) are part of commodity “Margarine etc” (GGIO code 1541300). In turn, waste types that belong to different eural codes (combustion waste, 12.42 and copper waste, 6.24) can belong to the same NA waste category (copper waste, 274430). In chapter 6 on the practical implementation of different data sources, the problems that arise from having waste categories that do not match will be discussed extensively. One of the problems occurs when calculating the amount of re-export for certain waste types. Sometimes the percentage of re-export of a waste type can only be calculated on the basis of the aggregated commodity it is part of. Another problem of having non-matching waste categories is the loss of a direct link between the national accounts data and the detailed FTS data.

The latter problem renders the use of the FTS data not possible for application of the following method: From the registered monetary and physical data a unit value (euro per Kg waste product) could be calculated. In order to check for inconsistencies, rates for similar products could be compared in time and between companies. If the waste categories would have matched, the total physical import and export could be estimated by applying the unit value to the monetary data adjusted after implementation in the NA.

In all, data from FTS seem to have some drawbacks. However, it may complement data on import and export obtained from IMA (Internationaal Meldpunt Afvalstoffen – i.e. International Waste Notification Office) (see section 5.2.2). Especially waste from the green list (Annex II of the Council Regulation (EEC) no. 259/93) that is not covered by the IMA might by estimated by the FTS. The green list includes wastes that pose the least hazard to human health and the environment and are subject to the same level of control as normal trans-boundary commercial shipments. Waste from the green list is most valuable and, therefore, most likely to occur in the FTS. Notice that, the amounts of waste found for each category is underestimated because waste with a total value of less than a million euros is not included. For waste product this might be a problem as they generally have a low value.

In commission of Eurostat a number of countries conducted a pilot study on the use of FTS to estimate import and export of waste not covered by the waste statistics regulation (WStatR) (Medina-Rosales, 2005). They concluded that the FTS are a good source for the following waste types: metallic waste, plastic waste, paper and cardboard waste, glass waste, textile waste and combustion waste.

In conclusion:

- The FSR statistics might be useful to estimate the amounts of waste from the green list. Notice that they estimated amount must be considered a minimum.
- FTS data is only concerned with waste products.
- FTS waste types as they appear in the NA do not exactly match the waste types defined by the WStatR. Therefore, a direct link between the NA and data derived from the FTS cannot be made.

5.1.4 Industrial Waste Statistics

Every even year Statistics Netherlands conducts a sample survey under NACE 10-41 to collect physical data on waste production and waste treatment. Only companies with 10 or more employees and no environmental annual report are included in the survey. Environmental annual reports complement the survey. Finally, the sample data are incremented to represent the total for the whole population. Odd years are estimated on the bases of the previous year, the increase in the amount of production and environmental reports.

Data are presented on Statline (CBS, 2005b) for organic waste (o.a. paper, wood, plastic and biological waste), inorganic waste (o.a. ferro, non-ferro and stone), sludge (o.a. organic and inorganic) hazardous waste (only internally treated waste and waste not compulsory to report), mixed waste and other separated waste (o.a. paper rejects). From data collected by the survey more waste categories can be distinguished. Of the total amount of each waste category, the percentage that consists of packaging waste is also recorded. Not included are externally treated hazardous waste, radioactive waste, construction and demolition waste and slag from waste incineration. However, contaminated soil that results from construction and demolition activities is not considered construction and demolition waste and should therefore be reported in the questionnaire. Hazardous externally treated waste is reported to the LMA (see section 5.2.1).

On Statline, statistics on industrial waste make a distinction between final treatment methods (incineration and disposal on land) and recycling (“hergebruik”). A distinction between internally and externally final treated wastes could also be made. Internally recycled waste is not taken into account in these figures. Only waste generated by the company itself must be reported on the questionnaire as internally treated waste. Internally treated waste obtained from other companies should not be reported. From 2004 onwards, waste incinerated for energy recovery will be recorded separately from other incinerated waste. In previous years waste incinerated for energy recovery was booked under incineration. The following final treatment methods are discerned: incineration, disposal (also temporal storage of waste on company premises is in included), sorting and separation (externally) or other (o.a. treatment of sludge by sewage and refuse disposal services). Statistics Netherlands records waste at the time it is generated. Thus only the first treatment method is recorded. Drying of sludge is also booked under incineration. There is a possibility to separate the amount of sludge from other incinerated waste. Furthermore, a distinction is made between companies of different sizes and between waste from the production process and waste from other processes.

The NACE classification presented on Statline distinguishes about 30 categories. A more detailed classification is problematic considering secrecy and sample size of the survey.

In conclusion:

- Data from NACE 10-40 on waste production and treatment are collected. Exceptions are: hazardous waste reported to the LMA, radioactive waste, construction and demolition waste, slag from waste incineration, internally recycled waste, treated waste from another company and waste already reported at the first time of treatment.
- Statistics on industrial waste appear very useful as input to the physical waste accounts.

In order to compile time series the following should be taken into account:

- Only from 2001 onwards companies with 10 or less employees are included in the data.

- From 2000 onwards the definition of waste is extended to match the definition used by VROM. This means that by-products (residuen) are also included. They are always booked under “hergebruik”.
- From 2004 onwards waste is arranged according to Eural classification. The Dutch waste classification will no longer be used. As a result some waste will be categorized differently (for example hazardous waste will become non-hazardous waste and visa versa).
- In 2002, shredder waste from NACE 37 was no longer a part of “mixed waste” but changed to “other separated waste”.
- From 2004 onwards, incineration with the purpose of generating energy is considered recovery and no longer incineration. Waste treated in an incineration plant (AVI’s) is always considered to be incinerated although in this process energy is often generated.
- From 2004 onwards, Statistics Netherlands issues a survey adapted to Eural codes. The 2004 survey differs from the old one on the following points:
    - Process-dependent waste is no longer specified. Eural codes for each type of waste have to be filled in. In comparison to the previous survey more waste categories are specified.
    - Incineration of waste for the purpose of generating energy is explicitly asked for.
    - By-products can be reported in a separate section. For 5 NACE categories different by-products are suggested.
- From 2004 onwards externally treated non-hazardous waste has to be reported to the LMA. It is conceivable that eventually SenterNovem will start their own statistics on industrial waste.

5.1.5 Statistics on private recyclers (NACE 37)

<u>Physical</u>

Physical data on recyclers can be obtained from the statistics on industrial waste (see previous chapter). Recyclers (a distinction is made between recyclers of metal (NACE 37.1) and other materials (NACE 37.2)) are asked to report the total amount of waste (both hazardous and non-hazardous) they obtain for recycling. They have to estimate the amount of residues that remain after recycling. Of these residues the amount recycled, incinerated or disposed off is estimated. Notice, that waste produced by recyclers has already been recorded at the place where the waste was first produced. Adding the waste produced by recyclers to the waste produced by other establishments will lead to double counting.

In conclusion:

- In order to show waste flows the physical data collected on recyclers seems very useful. In order to present the total amount of waste produced, the recyclers could be omitted.

Monetary

In a separate survey, recyclers (NACE 37.1 and 37.2) are asked for monetary data. Considering the relevance for the waste accounts, data are collected on sales of waste products (o.a. high caloric products that can be used as fuel, metal, glass, different types of granules, fats and oils and reprocessed slag) and compensation received or money spent on waste collection (o.a. biomass and high caloric waste, photographic waste, glass, plastic, metal scrap (o.a. car wrecks), construction and demolition waste, rubber (o.a. car tires), fats and oils, slag and ashes). Other financial information on waste treatment expenditure and received subsidies is also collected.

From 2001 onwards, the processing of data collected from the survey has been changed. First of all, the collected data are not given enough attention in order to eliminate all errors. Secondly, the factor that raises the collected sample data in order to account for the total recyclers has become very robust. One single factor is used for all recyclers without regard of their size or activities. Thirdly, the different waste types are not considered when establishing the sample population. For example plastic waste is mostly recycled by a few small companies that might not appear in the sample population. As a result the final data on specified waste items are no longer reliable. Therefore the Statline publication of specific waste items has ceased in 2002. From 2001 onwards only the total turnover are published.

For reasons mentioned above, data from the survey on recyclers are no longer used as input to the NA. In the NA, estimates for different types of waste are based on general developments of production and number of employees.

In conclusion:

- Specific monetary data from this statistics can only be used in combination with other data sources.
- It might be possible to use the reliable data from 1998 until 2001 to estimate data of later years.

In order to compile time series of the monetary data the following should be taken into account:

- From 2001, reliable data on specific waste items is no longer available.
- Before 2002 biomass and high caloric waste (and their derived waste products) were not specific asked for in the questionnaire. The amount of biomass waste is probably underestimated because not all establishments that can be considered biomass recyclers were included in the survey at that time.

- From 1998 onwards, data on recyclers of fats and oils were properly included in the statistics. Before 1998 these recyclers were not considered NACE 37.
- Electronic data are only published from 1997 onwards. From 1993-1997 the recyclers were included in the statistics on private sewage and refuse disposal services.

5.1.6 Statistics on private sewage and refuse disposal services (NACE 90)

Monetary

Statistics on NACE 90 provide data on waste treatment expenditure. There is no record of physical data. NACE 90 is made up of sewage disposal services (NACE 9000.1), refuse collection (NACE 9000.2), refuse treatment and processing (NACE 9000.3) and decontamination (NACE 9000.4). Notice that only private establishments are considered. In the statistics before 2002, NACE 9000.3 was further divided into o.a. landfills, incineration plants, sorting plants, hazardous waste treatment and composting. The main reason this division is no longer provided is because single companies were more and more conducting multiple activities. To compensate for the loss of information the questionnaire was extended with questions on the turnover of different activities and services provided. Examples of different activities are: waste collecting, waste sorting, waste storage, waste incineration, treatment of sludge, treatment of manure, composting and decontamination.

Unfortunately, due to the same reasons mentioned for the monetary data on the recyclers (NACE 37), specific data on activities are not reliable enough to use.

In conclusion:

- Specific data beyond 2002 can not be used directly, it might complement other data sources.
- It might be possible to use the detailed data from 1997 until 2001 to estimate data of later years.

In order to compile time series the following should be taken into account:

- From 2002 onwards, methods and procedures on the statistics of NACE 90 have changed. As a result, some of the data of previous years can not be compared with data from 2002 and onwards.
- From 1993 - 1996 less detailed data on NACE 90 were published. In this period the recyclers (NACE 37) were also included.

Physical amounts of sewage sludge

Several statistics collect physical amounts of sewage sludge. SenterNovem collects data on sewage sludge that is considered hazardous waste. Statistics Netherlands collects data on non-hazardous sewage sludge (statistics on industrial waste). However, no data for NACE 90 are collected. Statistics on non-government waste water purification by Statistics Netherlands show data on sewage sludge generation (no distinction between hazardous and non-hazardous waste) of all NACE categories including NACE 90. Data on treatment methods are also available. Hazardous sewage sludge is already accounted for (SenterNovem see below) but non-hazardous sewage generated by NACE 90 should be added as a waste flow from NACE 90. However, it seems to be difficult to separated hazardous and non-hazardous sewage sludge in the statistics on non-government waste water purification.

In conclusion:

- In potential these statistics on physical amounts by Statistics Netherlands contain valuable information on NACE 90. In practice this information might seem to be difficult to extract.

5.1.7 Statistics on communal sewage disposal services (NACE 90)

Monetary

Communal sewage disposal services are performed by water board districts. Statistics on the environmental expenditure by Statistics Netherlands of water board districts contains data on waste water treatment. Data collection takes place by analyzing annual reports.

Physical

Data on physical amounts of sewage sludge from public sewage works can be derived from statistics on purification of communal waste water by Statistics Netherlands. Communal sewage disposal services are performed by water board districts. In order to obtain data from water board districts, Statistics Netherlands conducts a survey. The survey also provides data on treatment methods.

In conclusion:

- These statistics by Statistics Netherlands contain useful input for the waste accounts.

5.1.8 *Statistics on car wrecks*

The amount and average weight of vehicles destined for disassembling is presented in the statistics on car wrecks. Data are derived from a database that contains the number of number plates that become invalid each year. The estimated weight is including tires (also the spare tire) and a half tank of petrol. Due to a lack of data, imported car wrecks are not included. Car wrecks are not allocated to NACE. Most companies will dispose of there vehicles (by sale or export) before they are ready for demolition. A distinction is only made between passenger cars and other cars (van, trucks).

According to a specialist from Statistics Netherlands, the RIVM made an attempt to determine the amount of exported car wrecks but did not accomplish. The RIVM was also not able to determine the amount of shredder metal out of one car. However, he ARN (Auto Recycling Nederland – i.e. Car recycling Netherlands), that will be discussed later on, does make estimations on recovered materials from car wrecks. According to the same specialist, international trade statistics can not be used for imported and exported car wrecks because the threshold for which companies are obliged to report is often not reached. However, wrecks exported outside the EU always need reporting. From 2005 onwards, data on bicycles, motorbikes, caravans, trailers etc. will also become available.

In conclusion:

- These statistics provides useful information especially in combination with data from the ARN on material recovery from car wrecks.

5.1.9 *Statistics on waste collected by municipalities*

Physical

These biennial (even years) statistics are compiled from data collected by a survey among all municipalities. Some additional data are collected from refuse collection and treatment companies. The amount of waste collected or commissioned to collect by municipalities is presented in statistics on communal waste. Textile and paper collected by others (charities, schools etc) are also included. A distinction is made between waste from households (a small part might be from companies that present their waste for collection at the same time households do), cleansing services and other. Household waste is divided into the following waste categories: o.a. construction waste, green waste (GFT), garden waste, wood, soil, paper, glass, textile, chemical waste, metal, plastic, electric machinery, bulky waste and other (almost half the total). Waste from cleansing services and other waste are divided into the following categories: o.a. waste from sweeping, green waste and waste from service industries. The composition of these different waste categories is often not exactly known. Research on the composition of household waste was conducted by SenterNovem (section 5.2.5).

For household waste, bulky household waste, cleansing services and other waste a differentiation between treatment methods is made. Of these waste types the percentage re-use, incineration, disposal on landfills, composting and sorting is given. The survey also provides information on the collector of household waste: municipalities, store specialized in recycled goods, private collectors and others (charities, schools etc.).

<u>Monetary</u>

Every two years (odd years) monetary statistics on waste cleansing activities by municipalities are compiled. Data are collected by a small survey among all municipalities. Additional data are collected from annual reports and refuse collection and treatment companies. Also, information from the physical statistics on municipalities is used.

Municipality expenditure on waste collection is presented for two activities (cleaning of streets/markets and waste collection) and two executive services (own municipality and others). Waste collected separately is divided in chemical waste, glass, paper and cooling/freezing equipment. Expenditure on waste treatment is divided into incineration, disposal on landfills, composting and sorting. Income is generated by waste levies, waste intake, cleaning of markets and other.

Not all waste from household is included. For example bulky waste collected by industry is not included.

In conclusion:

- These statistics seem very useful. Some adjustments to the data have to be made in order to show to total amount of waste from households.

5.1.10 Waste from agriculture, forestry and fishery (NACE 01, 02, 05)

Waste from agriculture and forestry is not being monitored. Current data are based on research conducted in 1997 by the LEI (Landbouw economisch instituut - i.e. Agricultural Economics Research Institute) (Meusen van Ona, *et al.*, 1998). Every year data are estimated on the basis of the 1997 results and developments in the agriculture industry (for example scale of livestock or acreage of greenhouse farming). This method of estimating data is not considered very accurate. Also, little is know about the way in which waste is treated.

In commission of Eurostat, Statistics Netherlands conducted a pilot study to determine a reliable method to estimate waste flows resulting from activities performed by agriculture, forestry and fishing (Verbockhaven and van Beusekom, 2004). The study estimates the quantities and treatment methods of several waste types for the year 2002 (table 1 of the study). Around 14 sub-classifications of NACE 01, 02 and 05 are distinguished (table 3 of the study). This study together with other European studies will contribute to harmonize the monitoring of waste in member countries.

Statistics Netherlands adopts the following philosophy when determining substances as waste or no waste: Waste that is not removed from the place of occurrence is not considered waste. Examples of this kind of waste are remains from harvesting or remains from wood cuttings. This principle is in accordance with point of view of the Dutch government (VROM).

In conclusion:

- This data source will provide useful information on the waste accounts.

In order to compile time series the following should be taken into account:

- In the near future a new method will be introduced to estimate waste from agriculture and forestry. It is likely that the results of this new method will not be according to the results obtained in the old method. Also, reliable data before 1997 are not available.

5.1.11 Statistics on environmental expenditure of industries (NACE 10-41)

Every year Statistics Netherlands conducts a sample survey under NACE 10-41 (excluding NACE 36631 and 37) to collect data on environmental expenditure. Only companies with 10 or more employees are included in the survey. Finally, the sample data are incremented to represent the total for the whole population. Considering waste, questions are asked about on site expenses on waste storage, waste treatment and waste reduction facilities. The survey also contains questions on external payments (to government or private institutes) for waste disposal. A distinction is made between a few waste types.

In conclusion:

- This data source provides in potential useful monetary information on expenses made on waste disposal and waste abatement. However, on practical terms it seems difficult to make a clear distinction between the different types of expenses.

5.2 SenterNovem

SenterNovem is an agency of the Ministry of Economic Affairs. Activities in the field of waste monitoring have recently transferred to SenterNovem. From 2005 onwards activities of the AOO (Afval Overleg Orgaan – i.e. Waste Management Council) are conducted by SenterNovem. VROM commissioned AOO to implement and monitor waste management, to stimulate prevention of waste generation and waste separation, to explore future developments on the national and international waste market and to provide information on waste management. From 2005 onwards, tasks performed by the LMA (Landelijk Meldpunt Afvalstoffen - National Waste Notification Office) and IMA (Internationaal Meldpunt Afvalstoffen – i.e. International Waste Notification Office) will be conducted by SenterNovem. From 1994 onwards transports of hazardous waste were reported to the LMA. From 2005 onwards the same applies for non-hazardous waste. The LMA uses the LIA (Landelijk informatiesysteem Afvalstoffen – i.e. National waste data system) to keep record of the registrations. The LMA also manages the MRS (Meldingen Registratie Scheepsafvalstoffen – i.e. registration of shipping waste) with data on hazardous waste offered by the shipping industry. The IMA gathers data on im- and export of waste that appears on the red and amber lists (Annex III & IV of the Council Regulation (EEC) no. 259/93). Wastes from the amber and red list are more hazardous and are subject to stringent requirements. Data are processed in the IER (Informatiesysteem EVOA-Regeling – Datasysteem waste shipment regulation). Both IMA and LMA were under authority of VROM. AOO commissioned a research bureau to gather data on waste from retail trade, offices and services (KWD waste). SenterNovem together with Statistics Netherlands and RIVM publish a complete set of waste generation and treatment data on the internet (www.mnp.nl/mnc). Below, all data on waste gathered by SenterNovem are discussed.

5.2.1 Hazardous waste

For the years 1993 until 1997 Statistics Netherlands biennially compiled statistics on hazardous waste based on a survey from the LMA (CBS, 2005e). Law (Wet Milieubeheer) required that collectors and processors of hazardous waste had to report to the LMA. Companies that receive hazardous waste have to report waste origin, waste type and the amount. From 2003 onwards, reporting needs to be done according to the Eural (European list of waste products) codes. From 1998, the LMA (in commission of the AOO) publishes figures on hazardous waste (o.a. Meurs, 2002). From 1997, statistics on hazardous waste by Statistics Netherlands were terminated.

In the publication by Meurs (2002), considering 1998-2000, different registrations (LIA, MRS and IER) are validated and combined in one database. Extra information is added to this data base in order to categorize hazardous waste, to determine waste origin and destination and to determine treatment method. Also, companies were allocated to NACE-codes. Unfortunately, the old NACE classification of 1974 was used instead of NACE'93. For 2001 the LMA was not commissioned by the AOO to compile data. Therefore, no data on hazardous waste are available for 2001. From 2002 onwards, SenterNovem compiled data on hazardous waste themselves. Unfortunately this resulted in less detailed data.

Internally processed hazardous waste does not need reporting to the LMA and is, therefore, not included in data presented by LMA. Fortunately, Statistics Netherlands keeps track of internally processed hazardous waste in their waste survey.

In conclusion:

- This data source is useful in order to set up the waste accounts. Unfortunately, the allocation to NACE is on the basis of NACE'74. Another concern is the reduction in available detail after SenterNovem took over (from 2002 onwards) the analysis of the LMA registration.

5.2.2 Import and export of waste

From 1994 until 2004 the IMA were commissioned by VROM to supervise and control the implementation of the WSR (Waste Shipment Regulation - EEC regulation 259/93; in Dutch: Europese Verordening voor Overbrenging van Afvalstoffen - EVOA). The regulation applies to cross-border shipments of waste. It concerns the application of a system of prior authorization for the shipment of waste for disposal or for recovery. Cross-border transports had to be notified to the IMA. Notification is necessary for waste on the hazardous waste list (red-list) and semi-hazardous waste list (amber list). Exempt from notification is non-hazardous waste from the green list that will be applied usefully (for coverage of waste from the green list see the section 5.1.3 on the Foreign Trade Statistics). For some non-OESO countries notification of waste from the green list is also required. Transport notification can be divided into waste deposits, withdrawn waste deposits, waste received and waste treated. Around 98% of the waste deposits are reported to the IMA. The IMA registrations were used to construct an overview of import and export of different waste types. Every year a report is published on the import and export of waste (Meurs, 2004). Unfortunately, the waste types in this report are categorized according to Dutch LAP codes (VROM and AOO, 2004) and not according to the European eural codes. In Annex II of the report, besides the amount of exported waste for each waste type, the companies disposing and receiving the waste are reported. There is also information on waste treatment method. In Annex III the same information is given for the imported waste. Annex IV and V provide extra information on treatment methods for the total amount of waste.

In conclusion:

- In potential the registration of cross-border waste transports provides a good deal of information. There is extended information on waste type, treatment method and companies involved. The main problem is that hardly any information is available on waste of the green list. In the near future SenterNovem will start analyzing the IMA registrations themselves.
- Some adjustments to the data have to be made in order to make the data compatible with other data sources. The import-export data have to be allocated to eural codes. This might turn out to be difficult. Also, for some of the reported waste it is not clear if it is hazardous or non-hazardous waste.

5.2.3 Waste from retail trade, offices and services (NACE 50-99)

From 1992 onwards Motivaction International B.V. conducts research on packaging waste in industry and “retail trade, offices and services” sector (KWD-sector). This research was commissioned by VROM (for 2002/2003 by AOO) and based on a sample survey. From 1999 onwards, the sample survey was extended (Motivaction, 2004). The survey contains questions on the amount of separate and mixed waste. From 2000 onwards, the composition of mixed waste was asked. From 2003 onwards, the amount of organic waste is added to the survey.

The following waste types are distinguished: paper, glass, wood, textile, plastic, ferro, aluminum and organic waste. Also, companies are classified to NACE-codes and size. Unfortunately, the old NACE’73 was used instead of NACE’93. The following NACE categories are distinguished: 61-64 + 87, 65-66, 67, 68, 70-79, 80-86 + 88 + 89 and 90-99. The results are presented in table 3.5 of paper by Motivaction (2004).

According to a waste specialist the results of the Motivation survey are somewhat inaccurate. The sample survey is too small for some NACE classes with specific waste (for example sludge from NACE 90). Also, Motivaction admits that reported amounts are often coarse estimations. The response percentage is only about 16%.

In conclusion:

- This data source does not seem accurate for all waste types. Therefore, some adjustments to the data have to be made in order to be able to use them.

In order to compile time series the following should be taken into account:

- From 2000 onwards the survey was extended (see above) and more information on waste types became available. Results before 2000 are difficult to estimate on a detailed basis.

5.2.4 Waste from construction industry (NACE 45)

Between 1991 and 1997 a survey was conducted to obtain data on waste from construction industry by an institute associated with the construction industry (Belangenvereniging Recyling Bouw- en Sloopafval and thereafter Eerland Stoffenkringloop). The survey took place under companies that process construction waste. The amount of construction waste for 1998 and after is based on estimates. Also, the waste treatment methods are based on estimations. In the near future, results of a new study on construction waste are expected. These results will probably give a better indication of the amount of construction waste and its composition.

In conclusion:

- This data source, although not very accurate, provide useful information.

5.2.5 Waste from households

Data on waste from households are derived from the statistics on waste collected by municipalities by Statistics Netherlands (see section 5.1.9). SenterNovem makes some adjustments to the Statistics Netherlands data in order to come to amounts of waste (and bulky waste) from households (AOO, 2004b):

- A percentage of construction waste is allocated to the construction industry.
- An estimated extra amount of white and brown goods are added.

- The total amount of collected paper is taken from another source.
- Different treatment methods than the ones differentiated by Statistics Netherlands are reported.

SenterNovem also estimated the composition of undifferentiated household waste (SenterNovem, 2005). A distinction is made between paper, plastic, glass, ferro, non-ferro, textile, chemical waste and other. Packing waste is also distinguished.

In conclusion:

- This data source will provide useful information for the waste accounts.

5.2.6 Waste from transport (consumers, NACE 05, NACE 60-63)

The main data source is the statistics on car wrecks by Statistics Netherlands (see section 5.1.8). In addition SenterNovem estimates the amount of used car tires and the amount of waste from the shipping industry.

From the shipping industry, only hazardous waste emitted in the Netherlands is considered (LMA registrations). Nothing is known about non-hazardous waste. Waste of both Dutch and foreign ships (including fishing boats, NACE 05) are included in the total amount. According to the NAMEA methodology only waste from Dutch residents should be taken into account. Also, waste from fishing boats has to be distinguished from the total and allocated to NACE 05.

All waste flows together can be considered waste from transport. SenterNovem also determines the way in which waste is treated. These results are based on rough estimations. In 2002, shipping waste was allocated differently to treatment methods as in previous years. Incineration with the purpose of gaining energy is considered recovery. Also, disposal of waste water (water that remains after waste treatment) is no longer allocated to recycling but to discharge.

Apparently some shipping waste consists of water that is being discharged. Polluted contents in waste water should be recorded in the NAMWA and not in the NAMEA. After waste water treatment (after waste is separated from the water), the NAMWA should record the polluted contents as absorption by waste treatment plants (similar as for sludge). Dry waste that results after waste water treatment (separated from water) should appear in the NAMEA waste accounts. Thus, in the waste accounts only dry matter waste should be included.

In conclusion:

- Data from shipping industry only concern hazardous waste. It has to be adjusted before it can be used. The data have to be attuned to data that appear in the NAMWA (also concerning the separation of waste from fishing boats, NACE 05).

In order to compile time series the following should be taken into account:

- In 2002 the allocation of waste to different treatment methods has changed.

5.2.7 Waste from suppliers of energy (NACE 40, NACE 10-11)

SenterNovem regards electricity plants (NACE 40) and "mining and quarrying" (NACE 10-11) as suppliers of energy. Data from mining and quarrying are taken from statistics on industrial waste by Statistics Netherlands. An adjustment is made by subtracting dredging sludge and light contaminated soil from the total amount.

For NACE 10-11, the current NAMEA data include a little dredging sludge and light contaminated soil. Not included are dredging sludge from canals and harbors, and not included is contaminated soil from factory sites or petrol stations.

To estimate waste from electricity plants SenterNovem obtains data from the Vliegasunie (and not statistics on industrial waste by Statistics Netherlands).

In conclusion:

- It seems more straightforward to use the Statistics Netherlands data on suppliers of energy.

5.3 Other data sources

5.3.1 Auto Recycling Nederland (ARN)

ARN (Auto recycling Nederland – i.e. Car recycling Netherlands) became operational in 1995 for implementing the policy pursued by the Auto & Recycling Foundation. The objective of the policy was to comply with European legislation, governing the recycling of waste originating from end-of-life vehicles. This legislation was set out in an EU Directive in 2000 and translated into Dutch legislation through the Management of End-of-Life Vehicles Decree in 2002. For 2004, the Management of End-of-Life Vehicles Decree, lays down that a recycling target of 85% must be met at least 80% of which must be material recycling and no more than 5% incineration.

Vehicles were deregistered as end-of-life vehicles by the RDW (official car registration body). This includes only cars and small delivery vans with four or more wheels and a Gross Vehicle Weight (GVW) not exceeding 3,500 kg). The car dismantling companies contracted by ARN processed 87% of the total number of dismantled vehicles.

Table 2 of the Environmental report 2004 (ARN, 2005), shows the types of materials and quantities recycled by the ARN system. Materials recycled are metals (75%), batteries, tires, bumpers, glass, coolants, oil, PUR foam, braking fluid, safety belts etc. The recycled materials (excluding metals) make up around 14 % of the total weight. Since the start of ARN the recycling percentages have remained the same.

Many types of data sources are used in order to determine the recycling percentage of a car. The metal content of end-of-life vehicles is determined on the basis of the ARN composition investigation of end-of-life vehicles; additionally, a number of external sources are consulted. ARN makes standard measurements weekly, taking account of any changes in the end-of-life vehicle population. These measurements which accurately reflect the average weight of the ARN materials per end-of-life vehicle appear in table 2 of the Environmental report 2004 against the actual quantities recycled.

The European Commission has drawn up requirements to ensure that the recycling yield will be reported in a comparable manner by all Member States of the EU. Expectations are that the 'definite' version will be published very shortly. The European calculation method might show a slight deviation in the future from the present ARN calculation method. According to the European Commission's calculation method, the reuse of components for example can be included in the recycling yield, unlike ARN's current method of calculation.

In conclusion:

- Data from the ARN are very useful especially in combination with the Statistics Netherlands data on car wrecks.

In order to compile time series the following should be taken into account:

- In the future the calculation method might change due to European requirements.

5.3.2 Working group on waste registration (WAR)

In 1991 the working group on waste registration (WAR) was founded by the RIVM, AOO, VROM and the association of waste processors (Vereniging

Afvalbedrijven – i.e Dutch waste management association). Nowadays, the RIVM no longer takes part and other institutes have joined the WAR. Annually the WAR publishes a report on waste processing in the Netherlands (AOO, 2004c). This report presents a survey of the annual amounts of waste processed by landfills, waste incinerators, compost installations and sludge processing installations in the Netherlands. These results are based on a questionnaire organized by the WAR in which several waste processing establishments participate: landfill sites, establishments with disposal sites of their own, waste incinerators, composting establishments and sludge treatment plants. The results of the survey are used by VROM for monitoring and evaluation of their waste policy. The following chapters discuss the available data from the survey for different waste treatment methods.

5.3.2.1 Disposal

Disposal on landfills

The amount of disposed waste is calculated for different waste types: o.a. sludge, soil, tires and scrap. Often these waste types are determined by the waste generator: waste from households, construction and demolition waste and waste from incineration plants. Until 2001 for each waste type, the amounts of re-used waste at a landfill is reported. From 2001 onwards the amount of bsb-(bouwstoffenbesluit)building materials is reported. Bsb-building materials are stony materials, for example soil and construction and demolishing waste, that are by law allowed to be re-used.

Onsite disposal

Sugar and starch companies use soil from potatoes and sugar beets to construct onsite ring dykes for storage. The WAR considers the use of the soil as disposal. Some of the soil is sold and applied to road construction.

5.3.2.2 Incineration

The amount of incinerated waste, excluding incineration of sludge, is determined. A distinction is made between different waste types. Waste that remains after incineration is specified and divided into disposal and recycling (o.a. for road construction and landfills).

SenterNovem analysis several data sources in order to get the total picture of the treatment of combustible wastes (AOO, 2004a). This picture is required for policy making on waste management. Not included in the analyses is recycled combustible waste (like paper), biomass especially cultivated for energy generation or internally incinerated waste. The analysis makes a distinction between waste types and waste origin.

5.3.2.3 Composting and fermentation

A distinction is made between the amounts of treated organic (gft) waste from households and other organic wastes. Other organic waste originated from o.a. auctions, agriculture and retail trade, offices and services. After treatment the resulting compost is sold. An attempt is made to distinguish the users of the compost: o.a. agricultural sector, export, local government. The import of gft waste in 2003 is almost reduced to zero.

5.3.2.4 Sludge processing

The total amount of processed sludge is established. A distinction is made between communal sludge from communal sewage works, industrial sewage works, oil en fats and other organic sludge.

In conclusion:

- The WAR data source seems very usable. However notice that the total amount of treated waste taken as the sum of all individual treatment methods is somewhat high because some waste is treated (and thus counted) multiple times.

In order to compile time series the following should be taken into account:

- In 2005 establishments will report their waste according to Eural codes. In previous years Dutch LAP codes were used. This might give some inconsistencies.
- Disposal: from 2001 onwards the survey does not contain a question on re-use anymore. Instead a question on the use of bsb (bouwstoffenbesluit)-building materials is added. Bsb- building materials are allowed to be applied for different purposes. However, the total amount of bsb- building materials is not the same as the total amount of recycled waste.

5.4 SenterNovem database

Recently SenterNovem put physical data from several sources together in a database. Of the above discussed data sources many were implemented in the database. From Statistics Netherlands (section 5.1) statistics on industrial waste, waste collected by municipalities and the survey on waste from agriculture, forestry and fishery were used. All data, apart from the import-export data, collected by or in commission of SenterNovem were used (section 5.2). WAR data were also used (section 5.3.2). At present, data are available for 2002 and 2003.

All data sources contain waste types labeled according to Dutch LAP codes and not to the European eural codes. SenterNovem converted the LAP codes to eural codes. This resulted in a database in which about 75 eural coded waste types can be distinguished. From 2005 onwards conversion is no longer necessary as waste registration will take place according to eural codes. On the supply side about 30 NACE categories are distinguished (notice that a small amount of waste could not be allocated to a NACE category). Waste is allocated to a waste category on the basis of its status at the time of generation. Thus, the amount of ferro waste refers to ferro waste that originated as such during a production of consumption process. This means that the amount of ferro in, for example, discarded vehicles or household waste is not included in the "ferro waste" category. However, other data sources, like the one on import/export, probably register ferro from different eural categories as "ferro waste". The inconsistency in time of recording between different data sources of the same waste categories might provide problems when integrating the data sources. Another inconsistency between data sources lies in the allocation of different substances to a single waste category. For example, the non-ferro waste category in the NA also refers to slag and ashes that contain non-ferro waste. According to eural codes definitions, the non-ferro waste category does not contain slag and ashes.

On the use side, only data on waste treatment methods are available for different waste types. Thus, no information on NACE is available on the use side. SenterNovem makes an effort to report final treatment method of specific waste types (recycling, landfill, incineration). Take for example discarded vehicles. Almost 100% go to a recycler but they are booked as 85% recycled and 15% landfill. However, the treatment of industrial wastes (CBS, 2005b) seems to be determined on the basis of their first destination after disposal. Thus, waste destined for a recycler is booked as 100% recycled even if a certain percentage ends up at a landfill. Notice that SenterNovem could not allocate all waste to a specific NACE, nor did they know the treatment method for all waste types.

The amount of generated waste does not equal the amount of treated waste. Reasons for this discrepancy lie in the difficulty of eliminating double counted waste, storage of waste and merging or separation of waste flows (and thus a change in eural code). An effort is made to remove double counted waste. Waste produced by NACE 37 consists mostly of remains from recycled waste. This waste has already been reported when first produced and is not included in the database. Therefore only a small amount of waste produced by NACE 37 is presented in the database.

The SenterNovem database contains data from registered waste at the time of generation. It does not contain specific data on the import/export of waste. However, the amounts of produced and treated waste reported at both the supply and use side include exported waste (but not imported waste). According to the concept of the national accounts, the amounts of treated waste on the use side should contain imported waste but not exported waste. Therefore, adjustments at the use side have to be made before the SenterNovem data can be implemented in the NAMEA. The SenterNovem data on the supply side do not need adjustment. As discussed before, in order for the SenterNovem data to fit the NAMEA concept a distinction has to be made between waste products and residuals.

In conclusion:

- The database integrates several different waste data sources. Therefore, it seems to be a suitable starting point to construct the NAMEA waste accounts.
- Data are originally not according to eural code. The allocation of waste types to eural codes was sometimes ambiguous.
- Some waste could not be allocated to NACE or treatment methods.
- The amounts of waste absorption need to be adjusted for import and export in order to fit the national accounting concept.
- In order to fit the NAMEA concept, the database needs to be separated in waste products and residuals.
- Comparing similar waste categories between different data sources can be problematic because of differences in definition and time of recording.

In order to compile time series the following should be taken into account:

- No data before 2002 are available.
- In future years data recording will be according to eural code.

5.5 Conclusions

Table 5.5 gives an overview of some of the properties of the individual data sources. These properties determine the usefulness of the data sources in order to set up the waste accounts. From this table the following conclusions can be drawn:

1. Useful monetary data related to waste products is scarce. In monetary terms waste products are often not given much consideration because of their low values.
2. Most monetary data are concerned with expenses made on waste treatment or waste abatement. It is doubtful if the nature of the

expenses or the waste types involved can be determined for many NACE categories.

3. It is difficult to link physical with monetary data because physical data concern both waste products and residuals as monetary data are either concerned with waste products or expenditure on treatment or abatement of residues.
4. Useful physical waste data are available on the supply side and for final treatment (SenterNovem database). On the use side not much data are available.
5. Useful physical import and export data are available.

Data source	Indus. Clas.	monetary	physical	imp/exp	supply	use	treatment	haz & n-haz	waste types	time series	**Use-fulness**	remarks
National Accounts	all	+	-	+	+	+	-	-	+/-	+	**+/-**	Only valuable waste is considered.
Prodcom	10 - 41, not 37	+	+	-	+	-	-	-	-	+	**-**	Very few waste types can be distinguished
Foreign trade statistics	all	+	+/-	+	-	-	-	+/-	+/-	+	**+/-**	Only waste with a value above threshold is considered
Industrial waste statistics	10-41	-	+	-	+	-	+	n-haz	+	+/-	**+**	
Private recyclers statistics - physical	37	-	+	-	+	-	+	+	+	+/-	**+**	
Private recyclers statistics - monetary	37	+	-	-	+/-	+/-	+/-	-	+/-	-	**-**	Only useful data between 1998-2001 available
Private sewage and refuse services statistics	90	+	+	-	-	+/-	+/-	-	+	-	**-**	Only useful monetary data between 1997-2001 available
Communal sewage and refuse services statistics	90	+	+	-	-	+	+	-	+	+	**+**	
Car wrecks statistics	housholds	-	+	-	+	-	-	-	-	+	**+/-**	Useful in combination with ARN data
Municipalities statistics	housholds	+	+	-	+	-	+	+/-	+	+	**+**	
Environmental expenditure statistics	10- 41	+	-	-	-	+/-	-	+	+/-	+	**+/-**	Difficult to distinguish waste type and treatment/abatement.
LMA - hazardous waste	all	-	+	-	+	+/-	+/-	haz	+	+/-	**+**	SBI ' 74 classification. S/N takes over monitoring.
Motivaction	50-99	-	+	-	+	-	-	-	+/-	+/-	**+/-**	Data not always reliable does to small sample survey.
IMA - import export	all	-	+	+	+	+/-	+/-	+/-	+	+/-	**+**	No SBI classification. S/N takes over monitoring.
Pilot study - waste from agriculture and forestry, fishery	01, 02, 05	-	+	-	+	+/-	+	+	+	-	**+**	Compilation method is still under construction.
Survey - waste from construction	45	-	+	-	+	-	+	-	+	+/-	**+/-**	Results from 2005 survey are essential
WAR -group on waste registration	90	-	+	-	-	+	+	-	+	+/-	**+**	
ARN- Car recycling Netherlands	housholds	+	+	-	+/-	+/-	+	-	+	+	**+/-**	Only car wrecks.

Table 5.5: Data availability and usefulness for 2002/2003

Looking at the available data the first step will be to set up physical waste supply and use tables. The database of SenterNovem can act as a starting point. The biggest challenges will be to determine the NACE categories on the use side, incorporate import-export and separate waste product from residuals. Depending on the effort it takes to compile physical supply and use tables, the physical data could be linked with monetary data (valuable waste products and expenditure for waste treatment/abatement). Finally, taxes, subsidies and fees concerning waste could be added. As it will turn out, due to a lack of time and appropriate data sources this paper will only deal with the compilation of physical supply and use tables.

6. Practical implementation of the data

This chapter discusses the representation of the physical waste data into balanced supply and use tables for waste products and residuals. In balanced tables the supply (import plus domestic production) equals the use (domestic absorption plus export). Currently, a manual with a detailed description on how to compile physical supply and use tables is under construction (Nooteboom, 2006). Subsequently this chapter discusses waste supply, import/export of waste, waste use, and balancing the supply and use tables. Up to section 6.4 the supply and use tables contain both waste products and residuals. Section 6.5 deals with compiling separate supply and use tables for waste products and residuals. In the subsequent section (6.6), incinerated waste and landfill waste are distinguished in order to make differences in the environmental impact as a result of waste treatment more explicit. The aggregated results of the practical implementation are shown in table 6.6. Section 6.7 compares the results of the current waste accounts with the ones developed in this paper. This chapter sums up with conclusion.

6.1 Waste generation

Data on physical waste generation are provided by SenterNovem. On request they provided data for about 75 waste categories (according to European (eural) codes) and more than 30 NACE categories (including households). For some waste types the amount was zero or no specific information was available (a distinction could not be made): packaging made of wood (7.51), worn clothing (7.61), bulky household waste (20 03 07) and solidified, stabilized and vitrified wastes (13).

Not all NACE categories could be distinguished on a level of detail required by NAMEA standards. The following NACE categories needed to be broken down in subcategories: NACE 01-02 (agriculture and forestry), NACE 24 (manufacture of chemical products), NACE 40-41 (electricity supply, gas and water supply), NACE 45 (construction); NACE 50-51 (wholesale trade), NACE 60-64 (transport) and NACE 65-99 exclusive 90 (services).

The following procedure was used to break down the aggregated NACE in required subcategories. First of all an attempt was made to identify, for each waste type, the expected producing industry. This was done with the help of waste experts and a detailed description of the production process for each industry branch. If this procedure was not sufficient, waste dependent on the production process (like waste from production materials or rejected products) was broken down according to shares value added. Waste independent of the production process (like office waste or waste from cleaning) was broken down according to the number of employees. This break down procedure can be adjusted on the basis of new information.

For most waste types, SenterNovem was not able to allocate a small amount to NACE categories. In order to allocate these amounts the following procedure seemed most logical to adopt. If the amount of waste, not allocated to NACE categories, was relative small (less than 10% of the total amount) it was proportional distributed among NACE categories. If the amount, not allocated to a NACE, was relative large, allocation took place on the basis of an expert guess. If these options were not satisfactory, allocations to NACE were made on the basis of information of a similar waste type. For example, an "unknown" hazardous amount could be allocated on the basis of the same non-hazardous waste type.

6.1.1 Specifics on the generation side

Agriculture, forestry and fishery (NACE 01, 02, 05)

Data on agriculture, forestry and fishery in the SenterNovem database are derived from a pilot conducted by the environmental department of Statistics Netherlands. However, some differences between pilot data and the database occur. Below, the largest differences are discussed.

It appears that SenterNovem and Statistics Netherlands allocate some waste types to different eural codes. An example is waste from rock wool substrate matting. Statistics Netherlands allocates rock wool to code 12.31 (mineral waste) as SenterNovem allocates it to 9.13 (waste of food preparation and products). Another example is animal carcasses and residues (9.11): Statistics Netherlands reports 186 kton and SenterNovem reports 58 kton. In case of SenterNovem, the waste consisted of infected animals. According to the eural code this should be recorded as 5.12 (animal infectious health care wastes). SenterNovem regards regular animal waste as industrial waste. Of the 186 ton recorded by Statistics Netherlands, 40 kton consists of fish rejected in the sea. The remaining 146 ton appears waste from agricultural animals (9.11).

Also, SenterNovem and Statistics Netherlands make some different assumptions on what to consider waste. For example, manure (9.31): SenterNovem reports 633 kton, Statistics Netherlands reports 14000 kton. Statistics Netherlands considers only manure removed from the production place as waste. SenterNovem does not consider manure as waste at all. The reported 633 kton consists of mushroom compost (which consists for a large part out of horse manure). In the current survey manure (9.31) is included. However, instead of adding the total amount of wet manure (14000 kton), the total amount of dry manure (1473 kton) was added (CBS, 2005f). The percentages of dry matter for each manure type were obtained from an expert in the field.

The above discussed differences indicate the ambiguity of allocating eural codes to waste categories. If two experts (Statistics Netherlands and SenterNovem) in the field of waste do not agree on waste classifications, how will establishments that have to report their waste in eural codes be able to provide information in a consistent and comparable way? In the supply and use tables presented in this report the SenterNovem database is used as a starting point.

Sludge types of waste: industrial effluent sludge (03.2), waste water treatment sludge (11.1), sludge treatment public sewage water (11.11), biodegradable sludge treatment other waste water (11.12), sludge purification drinking and process water (11.2), dredging spoils (11.3), cesspit contents (11.4). The amounts of these waste types are reported by SenterNovem inclusive their water content. In this survey the amount needs to be reported in dry matter. In order to convert wet sludge to dry sludge the percentage of dry matter is estimated. Estimation was based on Statistics Netherlands data (CBS, 2005g; CBS, 2005h) and expert guesses. Some waste categories, in particular industrial effluent sludge (03.2), contain various kinds of waste. For these categories a sound estimation of the percentage dry matter is difficult to make. Fortunately, from 2004 onwards the recorded waste data contain information on percentages dry matter (per eural code). This information will add to a better estimation of the amount of dry sludge.

6.2 Import - export

Data on import and export of waste are mainly obtained from two sources: the Foreign trade statistics (FTS) and the International waste registration centre (IMA). Data on waste types from the red (hazardous waste) and amber waste (semi-hazardous waste) list (Annex III & IV of the Council Regulation (EEC) no. 259/93) are obtained from IMA. Waste types that appear on these lists (mostly dangerous waste) need to be reported to the IMA. The IMA import-export data are divided in recovered waste and finally disposed of waste. On the basis of background details and expert guesses, eural codes were allocated to the different waste types. Waste types also had to be labeled dangerous or non-dangerous.

Data on waste types with a monetary value were obtained from the FTS compiled by Statistics Netherlands (CBS, 2005f). Eural codes had to be assigned to the different waste types. As discussed in section 5.1.3 it was assumed that in the FTS only waste types from the green list (Annex II of the Council Regulation (EEC) no. 259/93) appear. Data from the FTS (green list) and the IMA (amber and red list) can be considered complementary.

Transit trade is included in the FTS but not in the IMA data. Transit data on waste types recorded by IMA are not known. In order to match the FTS and IMA data, the FTS needs to be adjusted for transit waste. Unfortunately, the percentage of transit waste could only by estimated on the basis of aggregated commodity categories. In most cases, waste is only a part of these commodity groups. Applying a transit percentage derived from an aggregated commodity category to a waste category results only in a rough estimate of the amount of transit waste.

As mentioned earlier, due to a transformation process, exported waste of a particular type (eural code) can originate from waste that was, at the time of generation, recorded differently (different eural code). For this reason problems occur when integrating the export data with the use data. Take for example exported ferro waste (6.1). Household waste (10.11), discarded vehicles (8.1) and combustion slag (12.42) all contain ferro waste. Most of these waste types are being transformed before being reused or exported. Transformation, like sorting, results in ferro waste flows. When these ferro waste flows are being exported they will no longer be labeled the eural code they originated from (10.11, 8.1, 12.42 etc.) but they will be labeled ferro waste (6.1). As a result of this waste transformation, the recorded export of ferro waste exceeds the recorded production of ferro waste by far. At the same time, the recorded export of household waste (10.11), discarded vehicles (8.1) and combustion slag (12.42) is too low. The next section (6.3) will discuss the problems of integrating export data with use data in more detail.

Data from the FTS are on a higher level of detail than found in the national accounts. In order to implement the FTS data in the waste database the highly detailed waste groups were allocated to eural codes on the bases of their description. For 2003 the following waste groups were distinguished: chemical deposits and residues (3.11), ferro (6.1), precious metal (6.21), aluminum (6.23), copper (6.24), lead (6.25), other metal (6.26), glass (7.1), paper (7.22). plastic (7.42), wood (7.52, 7.53), textile (7.62, 7.63), batteries and accumulators (8.41), animal waste of food preparation and products (9.11), vegetable waste of food preparation and products (9.12), household waste (10.11) and slag and ashes from thermal treatment and combustion

(12.42). In some cases allocating eural codes to FTS types of waste was not possible: a FTS waste description could mention too many different types of waste or a waste description could mention both waste products and other kind of products. Thus, some amounts of waste could not be taken into account. As a result, the total amounts of some of the waste categories are too low. This applies for eural codes: 3.11, 9.11, 9.12 and 10.11. Notice that in general the amounts of waste found in the FTS must be considered with great care. Only waste with a value above a certain threshold (see section 5.1.3) needs to be reported when imported or exported. Waste with a value below this threshold does not appear in the data source used by the FTS to estimate imports and exports.

As a result of the detailed breakdown in waste types of the FTS data, a direct link to the monetary NA data is lost. For example, detailed FTS waste types distinguish lead waste (6.25), as the NA only distinguishes non-ferro waste (6.2). Also, non-ferro waste in the NA contains slag and ashes. In the detailed FTS data, according to eural definitions, slag and ashes are allocated to a different waste category (12.42).

6.3 Waste absorption

On the use side, SenterNovem provides information on treatment methods but not on waste use per NACE. The following treatment methods are distinguished: incineration with the purpose of waste disposal (D10), incineration with the purpose of generating energy (R1; excluded are waste incineration plants), landfill, discharging, recycling and other. However, due to a lack of data, consistent distinctions between treatment methods could not always be made. As a result some R1 incinerated waste is booked under D10 incineration. Also, internally dumped soil is sometimes considered “landfill” and sometimes considered internal recycling. In the latter case the soil does not appear in the database.

Determination of waste-use by NACE is done on the basis of several sources. From statistics on sustainable energy by Statistics Netherlands the amount of biomass waste incinerated at electricity plants is obtained. A distinction can be made between: wood (7.52, 7.53), animal waste of food preparation and products (09.11), vegetal waste of food preparation and products (09.12), mixed waste (09.13) and animal urine and manure (09.3). Also, data on waste incineration by a cement manufacturer (NACE 26) can be obtained. The cement manufacturer incinerates chemical deposits and residues (03.1), paper and cardboard wastes (07.22), animal waste of food preparation and products (09.11) and sludge from public sewage water treatment (11.11). Some data on waste use by NACE can be obtained from research reports or waste interest groups. Monetary data from the NA are also used to determine waste use by NACE. In the NA the following monetary data on waste use are available: ferro (6.1), precious metal (6.21), aluminum (6.23), copper (6.24), other non-ferro metal (6.26), glass (7.1), paper (7.22), plastic (7.42) and slag and ashes from thermal treatment and combustion (12.42). As discussed in section 5.1.1., it might be assumed that the monetary distribution of waste across NACE is similar to the physical distribution across waste categories. Therefore, the physical amounts of the above mentioned waste types can be allocated to NACE categories on the basis of the monetary distribution. Although this method is theoretically not completely sound, in practice it turns out that alternative methods do have problems as well. This point is discussed extensively in section 6.3.1-metallic wastes. Waste that could not be allocated to a specific NACE is allocated to the following NACE categories: recycled waste to NACE 37 and waste treated differently to NACE 90. However, the way in which SenterNovem reports use-data may pose some uncertainties on the above method of allocating waste to NACE 37 and NACE 90 (see section 5.4 on the SenterNovem database). Take for example batteries: in the SenterNovem database the treatment of batteries is reported as 86% recycling and 14% disposal. These data do not imply that 86% of the total number of batteries is recycled. They only imply that, after treatment, 86% of the materials are re-used. According to the method discussed above batteries are considered residuals of which 86% is used by the recyclers (NACE 37) and 14% is used by disposal services (NACE 90). Regarding batteries, this may be incorrect. Most batteries are probably first used by the recyclers (NACE 37), only after treatment do residuals end up at disposal services (NACE 90) and waste products at other (unknown) NACE categories.

Data on waste absorption from SenterNovem include exported waste but do not include imported waste. In order for the data to fit the accounting concept, on the absorption side, data corrections have to be made: export has to be subtracted and import has to be added to the absorption data from SenterNovem. Making these adjustments according to a particular methodology turns out to be difficult. A lot depends on the type of waste and the amounts given.

When calculating the adjusted absorption (absorption plus import minus export) for each waste category with disregard of treatment method some negative values occur. These negative values can be a result of allocating eural codes to the wrong waste category. However, they may also be a result of other uncertainties in the data. There are several types of adjustments to solve the occurance of negative values. Most adjustments involve transferring waste from one waste category to another (similar) waste category. All adjustments made in order to omit negative values are explicitly recorded. The difficulties that occur while adjusting the aggregated absorption data make adjusting the absorption data for separated treatment categories (landfill, incineration, discharge etc.) very difficult and time consuming. Therefore, it seems more appropriate to estimate amounts of waste for different treatment methods after the total supply and use tables are balanced.

6.3.1 Specifics on the absorption side

Sludge types of waste: (03.2), (11.1), (11.11), (11.12), (11.2), (11.3), (11.4). As discussed in the section on waste supply: the amount of sludge is presented in dry matter.

Contaminated soils and polluted dredging spoils (12,6) and Mineral wastes (12.3): Contaminated soil should be allocated to eural code 12.6, other soil should be allocated to eural code 12.3. In 2003, 939 kton contaminated soil ended up at a landfill (AOO, 2004c – supplement C-2). Only 21 kton was considered dangerous waste. From the non-dangerous waste, 488 kton was applied (bsb-bouwstof) directly as a covering layer for other waste. Hazardous contaminated soil is cleaned by landfill sites for the purpose of reuse (1950 kton in 2003). It is estimated that about 8000 kton slightly contaminated soil is applied outside landfill sites as building material. Also, cleaned soil (1600 kton) and soil removed from sugar beets and potatoes (1000 kton) is used as building material (road construction) (NACE 45). A small amount (120 kton) of the latter type of soil is disposed of on the site of the producers (sugar and starch industry, NACE 15). This amount is not implemented in the database because it is considered internal recycling. In 2003, 359 kton not-contaminated soil ended up at a landfill site (AOO, 2004c).

Slag and ashes from thermal treatment and combustion (12.42): In 2003, 69 kton of waste from incineration plants was disposed of at landfill sites. About 993 kton was reused. Of these 993 kton, 352 kton was applied usefully on landfills. The remaining waste, 641 kton, was reused in construction activities.

Household waste (10.11): Treatment plants compost about 1361 kton of green household waste (gft) in 2003 (AOO, 2004c).

Sludges purification drinking and process water (11.2), chemical deposits and residues (03.1) and mineral wastes (12.3, 12.5): Waste belonging to these categories is produced by water suppliers (NACE 41). Some of the sludge (60 kton) is reused by NACE 26 for brick production. NACE 41 dumps 20 kton of sludge onsite. Calcium granules are reused by NACE 27 (manufacturing of basic metals). About 15 kton of mineral waste is reused by unspecified NACE categories. Further information can be found on the SenterNovem website.

Animal urine and manure (09.31): As reported in section 6.1.1 on waste supply, manure in dry matter was added to the SenterNovem database. Only manure that is removed from the production site is considered. On the basis of agreements on manure disposal (on the basis of the amounts of nitrogen in manure) arranged by manure users, the destiny of manure per NACE is determined (CBS, 2004). It is estimated that 80% of the manure goes to agriculture (01.11), 5% to stock farms (01.2) and 15% to mixed farms (01.3-5, 02).

Metallic wastes (06)

In the metallic waste category two major discrepancies were found. The first one concerns a discrepancy between the production-absorption data and the import-export data on the amount of mixed metallic waste (6.3). In contrary to the import-export data, the production and absorption data show a relative large amount of mixed metallic waste. A reason for this discrepancy might be that the produced mixed waste is being processed before it is exported. This process may involve separating mixed waste into fractions of different waste types.

The second discrepancy concerns the total amount of metal wastes. After adjusting the production data for import and export to fit the NAMEA concept, negative values were found (NAMEA domestic production = SenterNovem production plus import minus export). According to a waste expert some waste flows may have been left outside the production-absorption registration. On the other hand, these flows probably appear in the import-export data. Therefore, it seems right to increase the total amount of metal wastes (production and absorption) to at least the total amount of export. However, NA data indicate that some amounts of waste metal are used by Dutch industries. The question is how to estimate these amounts? Obviously, the NA monetary data can not be used to allocate the physical absorption data (becomes zero after adjustment for export) to different NACE categories. The following procedure could be followed to estimate the absorption of metal waste by NACE. On the basis of the monetary NA data for each NACE category (and export) a percentage of the total absorption is calculated. From the FTS, the physical amount of exported waste is known. This amount corresponds with a percentage of export derived from the monetary NA data. Now, a physical amount can be estimated for the waste absorption per NACE on the basis of the monetary NA data. However, after adjusting the production-absorption data another problem occurred that made the above solution unusable. It turned out that metal waste from the FTS and NA data can not be compared directly to metal waste from SenterNovem data. Metal waste from the FTS contains all imported and exported metal waste regardless of the source the metal is derived from (see section 6.2 – import-export). Metal waste from SenterNovem contains only metal waste that is reported as such at the time of generation. Not included are metal wastes that result from treatment of other waste types. Thus, not included is metal scrap from car wrecks or metal waste derived from household waste. However, these metal wastes are included in the FTS data. Out of necessity to make an estimate of the amount of waste absorbed by NACE a rather disputable but simple method is used: allocate the physical FTS data to NACE categories on the basis of monetary absorption-ratios obtained from the NA data.

In order to solve both discrepancies between the FTS and SenterNovem data the amount of exported waste metal is adjusted to the waste metal found in the production and absorption data. The waste absorption per NACE category is estimated on the basis of absorption-ratios derived from the monetary NA data. This solution is not ideal and may result in an underestimation of waste metal flows. Future insight (see chapter 7) may lead to a better estimation of these waste flows.

6.4 Balancing

According to the national accounts concept the supply and use tables need to be balanced (i.e. domestic production plus import minus domestic absorption minus export equals zero). In order to balance the tables the following procedure is followed. First of all, the total production, import, absorption, export and balance for all waste types are presented in a table. If the balance shows an outstanding amount, the supply and use tables could still be adjusted. After the largest incongruities were eliminated a software application (Winadjust) was used to make small adjustments in order to balance the tables. The application is based on the Langrangian approach of finding a matrix that minimizes a certain distance between the new matrix and the original one using weights and constraint. In the next step the supply and use for each NACE needs to be adjusted according to the balanced totals. In order to accomplish this, the difference between the balanced total and the unbalanced total for each waste type is determined. Next, these amounts are distributed among NACE categories according to the share each NACE took in the total amount of waste. As a result balanced supply and use tables were calculated for all NACE categories and waste types.

6.5 Distinguishing residuals from waste products

Distinguishing residuals from waste products is necessary to reconcile the data with NAMEA conventions (see section 1.3.2). The current section attempts to divide the physical data in waste products and residuals. Due to a lack of reliable data, the distinction is based on NA supply data. The following procedure is followed. First of all, waste types that appear in the NA have by definition monetary values and can therefore be considered products. All other types of waste are considered residuals. Secondly, it is assumed that waste products supplied in the NA by NACE 51.57 (wholesale trade in waste and scrap) are former residuals (see section 5.1.1). Therefore, waste products supplied by NACE 51.57 appear as residuals in the supply and use tables derived from the registration data. In accordance with the above assumptions, for all waste types that appear in the NA the percentages of waste products are calculated (the waste supplied by all NACE categories except NACE 51.57 divided by total amount of waste supply). In order to calculate the above percentages, the monetary NA data are converted to physical data by using unit values (euro/kg). These percentages are used to estimate the amount of waste products and residuals in the supply and use tables.

Of the following waste categories, a percentage is considered a product: ferro (06.1) (10% waste products), precious metal (06.21) (17% waste products), aluminum (06.23) (41% waste products), copper (06.24) (13% waste products), lead (06.25) (22% waste products), other metal (06.26) (22% waste products), mixed metal (06.3) (22% waste products), paper (07.2) (19% waste products), plastic (07.4) (62% waste products) and slag and ashes from thermal treatment and combustion (12.42) (9% waste products). Notice that these percentages are coarse estimations.

The import-export data also need to be divided in residuals and waste products. IMA data are reported as recycled waste or finally disposed of waste. As a default recycled wastes from IMA and the FTS are considered waste products. Disposed wastes from IMA are considered residuals. The above method results in supply and use tables for waste products and residuals. Notice, that here the assumption is made that imported or exported waste products were generated as such and do not arise from produced residuals.

As it turns out, due to the adjusted import-export data, the individual tables for products and residuals are no longer balanced. In order to balance the product and residual tables the following procedure is adopted. If the residual balance was larger than zero i.e. a supply surplus (for example: hazardous chemical deposits and residues, 03.1), the amount of production is decreased with the balance amount. In case of a negative balance i.e. a use surplus (for example: non-hazardous glass wastes, 7.1), the amount of absorption is decreased with the balanced amount). As a consequence the waste product tables are balanced by increasing the amount of production or absorption. In order to clarify the balancing procedure, table 6.5 shows the supply and use of the above discussed waste types before and after balancing. The reason to use this method seems very arbitrary. However, changing the amounts of production and absorption is any other way resulted in negative values. Another possibility is to balance the tables by changing the import/export amounts. It was decided not to alter the import/export data because they provide a strong indication on the differentiation between products and residuals.

		Production Residuals	Import	Absorption	Export	Balance	Production Waste products	Import	Absorption	Export	Balance
Before balancing	Chemical deposits	331.607	12.145	13.740	26.480	303.533	0	6.060	-	309.592	303.533-
	Glass wastes	531.564	-	711.936	-	180.372-	0	242.463	-	62.091	180.372
After balancing	Chemical deposits	28.074	12.145	13.740	26.480	-	303.533	6.060	0	309.592	-
	Glass wastes	531.564	0	531.564	0	-	0	242.463	180.372	62.091	-

Table 6.5: Supply and use of two types of residuals and waste products before and after balancing.

In order to compile complete supply and use tables for residuals and products, (distinguished into NACE categories) the procedure described in section 6.4 is followed. In the following chapters only the residuals supply and use tables are considered. The reason for the omission of the product supply and use tables is that they are not complete. Only waste products that occur as such at the time of generation are present in the tables. Waste products that arise from a treatment of residuals (for example recycled waste) are not taken into consideration.

6.6 Distinguishing treatment methods

In order to derive indicators that relate to environmental problems it is important to distinguish waste treatment methods: landfill, incineration and recycling. In order to determine these treatment methods the total domestic absorption is divided in three treatment categories: dumping/discharging (landfill and elsewhere), incineration (including incineration with the purpose of energy recovery) and recycling. The treatment categories are compiled on the basis of the original SenterNovem data on the amounts of treated waste. The share, in percentages, of each treatment method per waste category is calculated. These percentages are applied to the balanced data on residuals. Together with extra information on waste absorption by industry the waste treatment categories are determined. In theory, different treatment methods for each NACE category could be calculated. However, the results of this exercise will be unreliable due to the many assumptions made while compiling the data. In table 6.6 the supply and use of residuals for aggregated waste types is presented. On the supply side a (aggregated) distinction is made in NACE categories, on the use side a distinction between recycling and incineration is made. Residuals destined to be land filled are presented as the environmental indicator of solid waste. In order to keep the table in legible, waste types and NACE categories are aggregated to a large extent. Annex 1 and 2 shows the full range of waste types and NACE categories that can be distinguished.

6.7 Comparing the current and new waste accounts

Comparisons between the current and new waste accounts are not straightforward as data of the two waste accounts are somewhat of a different kind. In the current NAMEA (CBS, 2005a) only incinerated and landfill waste are considered. For 2003, the total generated waste was nearly 11 million tons. In the new waste accounts recycled residuals are also considered. The total generated waste was nearly 60 million tons for 2003 (table 6.6). The amount destined to be land filled and incinerated is over 10 million tons. This amount is not far off the amount in the current waste accounts.

In order to estimate the total waste destined to end up in the environment (landfill and elsewhere) the amount absorbed by the economy was estimated. In the current waste accounts, the amount of waste incinerated by incineration plants (5 million tons) was taken as the total amount of absorption. Therefore, the amount of waste emitted to the environment is almost 6 million tons. In the new waste accounts, absorption is determined by the total amount of incinerated waste (about 7,5 million tons) and the amount of residuals returning to the economy (about 46,5 million tons). In the new waste accounts import (nearly half a million tones) and export (nearly 4 million tons) is also considered. The total amount of waste emitted to the environment (equals the amount of land filled waste) is 2,7 million tons. This amount is considerably lower than the current waste accounts mainly due to higher amounts of absorption by waste incineration.

Another difference between the current and new waste accounts is the way in which sludge wastes (except communal sludge) are reported. In the current waste accounts only the amount of communal sludge is recorded in dry matter. In the new waste accounts all types of sludge are recorded exclusive its water content.

6.8 Conclusions

On the basis of this survey, the current NAMEA waste accounts are extended in several ways. Firstly, the number of reported NACE categories is increased from about 40 to 58. The NACE classification is according to the renewed NAMEA classification. Secondly, about 75 different waste types, divided in hazardous and non-hazardous waste, are distinguished. The categorization of waste types is according to the new European waste regulation (WstatR, European Communities, 2002). This guaranties future data to be in a format that can easily be implemented in the NAMEA waste accounts. Waste categorization according to a harmonized standard facilitates comparisons between countries. Thirdly, another main extension to the current waste accounts is the implementation of cross-boundary waste flows. Finally, a distinction between residuals and waste products is made. As a result complete residual supply and use tables, thus including recycled residuals, can be presented in the NAMEA. In the current NAMEA a distinction between recycled residuals and products could not be made.

In chapter 3 more proposals were made for further developments of the waste accounts. The current paragraph discusses the proposals that were not implemented in this survey due to a lack of time or proper data sources. Some of these proposals are suggested for further development in chapter 7. Firstly, the new waste accounts do not take the resident principle into account. Sound estimations on waste emissions by residents in the rest of the world and emissions by non-residents in the Netherlands are difficult to make. Also, the amounts considered are probably relative small. For these reasons no effort is made to account for the resident principle. Secondly, a distinction between process dependent and process independent waste is not made in the new waste accounts. Although this distinction is made in some of the data sources, SenterNovem does not make this distinction in their database. Also, one of the main data sources, the industrial waste statistics, will cease to make this distinction from the 2005-data onwards. Thirdly, the distinction between internally and externally treated wastes has not been made explicit. Data on this topic turned out to be ambiguous at this time. This might improve in the near future. Finally, a very important extension of the waste accounts that was not implemented are the monetary waste accounts. The physical supply and use tables could be linked with monetary supply and use tables on waste. Such an extension is not easily made on the basis of the available data.

The main data sources used in this survey were the SenterNovem database and import/export data from the FTS and IMA. The SenterNovem database contains waste production and absorption data from different sources, each which their own reliability. Together the FTS and IMA data cover most, but probably not all of the import/export data. In order to get from the original data sources to detailed NAMEA supply and use tables many adjustments to the data had to be made. Some important adjustments were: allocating waste to NACE categories, converting sludge in amounts of dry matter, adding internal final disposal on the use side, allocating eural codes to import and export data, removing transit waste from FTS data, adjusting absorption data for import and export, balancing waste supply and use tables, distinguishing residuals from waste products and balancing residuals supply and use tables. Unfortunately, not all adjustments could be based on reliable estimations. In order to present meaningful data, the supply and use tables need to be aggregated. At the use side a distinction between NACE categories is not recommended.

7. Prospects for future development

1) Metal waste: The method used to estimate metal waste flows (see section 6.1.1) can be improved by fine-tuning the metal waste from the FTS with the metal data obtained from SenterNovem. An option is to determine which waste categories (for example household waste, discarded vehicles and slag from combustion processes) derived from the SenterNovem data contain metal waste. This knowledge may help to estimate the origin of waste metals found in the FTS, and result in an allocation of the FTS data to different waste categories.

2) Illegal waste: Recently newspapers reported high amounts of illegal waste transports. Waste transports could be illegal for many different reasons. Illegal transports can be of influence of the waste accounts. For example, if waste was not reported at all or was given the wrong eural code. An attempt can be made to estimate illegal transport and incorporate it into the waste accounts.

3) Alternative approach: The statistical bureau of Norway (Hass *et al*, 2002) proposes a method that determines waste on the basis of the supply of goods. The idea is that every product will end up as waste eventually. With the amount of produced goods and an average life span the amount of produced waste can be estimated. This method could also be used to estimate waste production in the Netherlands. The results can be confronted with the results in the current report. Confronting different sources gives an idea of the error made.

4) Resident principle: In the current survey the resident principle was not taken into account. In the future, an estimate of the waste production by residents abroad and non-residents in the Netherlands might be made on the basis of tourism accounts.

5) Environmental themes: In the current NAMEA the total amount of dumped or discharged waste is regarded the waste indicator. However, some types of waste might be of a bigger problem to the environment than other types of waste. Maybe an indicator could be developed that takes the environmental impact into regard.

6) Monetary waste accounts: Next to the physical waste accounts, monetary waste accounts could be calculated. They would contain information on the internal and external expenditure of waste abatement and waste disposal.

7) Treatment methods: A further distinction is treatment method (internal treatment, external treatment and recovery with the purpose of energy recovery) is desired. In the near future estimations of these treatment methods will be possible on the basis of improved data sources.

8) Analyses: Especially after a time series on solid waste flows is available, the waste data can be analyzed in several ways. For example a structural decomposition analyses can be performed in which annual changes in solid waste are decomposed according to their driving forces (de Haan, 2001).

8. Definitions

Throughout this report terms are used that can be subject to ambiguous interpretations. For clarity sake, the terms as they are used in this paper are defined below. Definitions are taken from several sources (mainly: www.waste.eionet.eu.int/definitions/waste).

Waste: refers to materials 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. It is irrelevant to the definition of waste whether it may have a commercial value or is capable of economic reutilization. According to this waste definition a list of waste categories and waste types is set up in the Waste Statistics Regulation (European Communities, 2002). Different types of waste are given a so called eural code.

Excluded are:

- Waste directly **recycled** or **re-used** at the place of generation (i.e. establishment);

- Waste materials that are directly discharged into ambient water or air.

Included are:

- **Reststoffen**: waste generated during the main production process that can be used as raw material in another production process without any treatment. Examples: waste from the manufacturing of human food products is used for animal food production; furnace slag is used as a raw material in the cement industry.

Considering "reststoffen" as waste is according to the policy of the Ministry Housing, Regional development and Environment (VROM and AOO, 2004).

The above used definition of waste is used by Statistics Netherlands in statistics on physical waste flows (CBS, 2005b). In order to structure the physical waste accounts according to the national accounting principles, a distinction needs to be made between waste products and residuals. Waste with an economic value to the generator is considered a **waste product**. Waste with no market value to the generator is considered a **residual**. Residuals can even have a negative price since often they bear removal or disposal costs.

Gross generated waste: the quantity of waste generated by all units in the national economy during an accounting period (including leakages from controlled landfill sites).

Net generated waste: the quantity of waste that is ultimately rejected into the environment (or onto a landfill site) following any recycling/re-use or predisposal treatment.

Incineration: Two types of incineration are distinguished. The first one is **thermal treatment of waste, not with the purpose of energy recovery**. This kind of treatment occurs mainly in waste incinerators (NACE 90). Although these incinerators sometimes produce energy, the waste treatment process is considered not with the purpose of energy recovery. The second type of incineration is one with the **purpose of generating energy**. This type of incineration often occurs mainly at electricity suppliers (NACE 40). Waste replaces a primary energy source that would otherwise be used to generated energy.

Recycling: the re-introduction of waste materials into the production processes so that they may be re-formulated into new products. For example, the re-introduction of old newsprint into a paper mill as an input into the production of new newsprint is considered recycling. Recycling is including organic recycling but excluding energy recovery.

Recovery: recycling including waste incineration for energy recovery. The term "**hergebruik**" is used by Statistics Netherlands to refer to recovery (thus not to recycling or re-use).

Re-use: occurs when end of life products and equipment or its components are re-introduced into a production (or consumption) process and used as an input in its original form. Glass bottles that are returned to the place of manufacture to be re-filled with new beverage products are an example of the re-use of residuals. All second-hand products are being re-used.

Disposal: incineration (not with the purpose of generating energy), deposition upon any land or discharge into a water body.

Treatment: the physical, thermal, chemical or biological processes, including sorting, that change the characteristics of the waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery. Final treatment results in waste destined for disposal. If treatment is not explicitly mentioned to be final, the term "treatment" refers to non-final treatment like recycling.

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Annex 1

Compound waste (01)	spent solvents (01.1)	
	halogenated (01.11)	h
	non-halogenated (01.12)	h
	acid, alkaline or saline wastes (01.2)	h
		n-h
	used oils (01.3)	
	motor oils (01.31)	h
	other oils (01.32)	h
	spent chemical catalysts (01.4)	h
		n-h
Chemical preparation waste (02)	chemical preparation waste (02)	
	off-specifiaction (02.1)	
	agrochemical waste (02.11)	h
		n-h
	unused medicines (02.12)	h
		n-h
	paints, varnish, inks and adhesive wastes (02.13)	h
		n-h
	other (02.14)	h
		n-h
	other (02.2, 02.3)	h
	packaging polluted (02.33)	h
Other chemical waste (03)	chemical deposits and residues (03.1)	h
		n-h
	industrial effluent sludges (03.2)	h
		n-h
Health care and biological wastes (05)	health care and biological wastes (05)	h
		n-h
Metallic wastes (06)	metallic wastes (06)	
	ferro (06.1)	n-h
	non-ferro (06.2)	
	precious metal (06.21)	h
	aluminium (06.23)	n-h
	copper (06.24)	n-h
	lead (06.25)	n-h
	other metal (06.26)	n-h
	mixed (06.3)	h
		n-h
Non-metallic waste (07)	glass wastes (07.1)	h
		n-h
	paper and cardboard wastes (07.2)	
	packaging (07.21)	n-h
	other (07.22)	n-h
	rubber wastes (07.3)	
	tyres (07.31)	n-h
	plastic wastes (07.4)	
	packaging (07.41)	n-h
	other (07.42)	n-h
	wood wastes (07.5)	
	packaging (07.51)	n-h
	other (07.52, 7.53)	h
		n-h
	textile wastes (07.6)	
	worn clothing (07.61)	n-h
	other (07.62, 7.63))	n-h
	waste containing PCB (07.7)	h

Discarded equipment (08)	discarded equipment (08)	
	discarded vehicles (08.1)	h
	discarded electrical and electronic equipment (08.2)	h
		n-h
	discarded machines and equipment components (08.4)	
	batteries and accumulators wastes (08.41)	h
		n-h
	other (08.43)	h
Animal and vegetable wastes (09)	waste of food preperation and products (09.1)	
	animal waste of food preparation and products (09.11)	n-h
	vegetal waste of food preparation and products (09.12)	n-h
	mixed waste (09.13)	n-h
	green waste (09.2)	n-h
	animal faeces, urine and manure (09.3)	n-h
Mixed ordinary waste (10)	household and similar wastes (10.1)	
	household waste (10.11)	n-h
	bulky waste (20 03 07)	n-h
	other	n-h
	street cleaning waste (10.12)	n-h
	mixed and undifferentiated materials (10.2)	
	mixed packaging (10.21)	n-h
	other (10.22)	h
		n-h
	sorting residues (10.3)	h
		n-h
Common sludge (11)	waste water treatment sludges (11.1)	
	sludges treatment public sewage water (11.11)	n-h
	biodegradable sludge treatment other waste water (11.12)	n-h
	sludges purification drinking and process water (11.2)	n-h
	dredging spoils (11.3)	n-h
	cesspit contents (11.4)	n-h
Mineral waste (12)	construction and demolition waste (12.1)	
	concrete, bricks and gypsum waste (12.11)	h
		n-h
	other (12.12, 12.13)	h
		n-h
	asbestos waste (12.2)	h
	mineral wastes (12.3, 12.5)	h
		n-h
	combustion waste (12.4)	
	waste from flue gas purification (12.41)	h
		n-h
	slags and ashes thermal treatment and combustion (12.42	h
		n-h
	contaminated soils and polluted dredging spoils (12.6)	h
solidified, stabilized and vitrified wastes (13)	solidified, stabilized and vitrified wastes (13)	h / n-h

Annex 1: Waste categories distinquised in the new waste accounts according to WStatR. (h = hazardous, n-h = non-hazardous).

Annex 2

Description	Classification code
Households transport	
Households other	
Arable farming	01.11
Horticulture	01.12
Live stock	01.2
Other agriculture	01.3-01.5, 02
Fishing	05
Crude petroleum and natural gas production	11
Other mining and quarrying	10, 14
Manufacture of food products, beverages and tobacco	15, 16
Manufacture of textile and leather products	17, 18, 19
Manufacture of wood and wood products	20
Manufacture of paper and paper products	21
Publishing and printing	22
Manufacture of petroleum products; cokes, and nuclear fuel	23
Manufacture of basic chemicals and man-made fibres	24.1, 24.7
Manufacture of chemical products	24.2-24.6
Manufacture of rubber and plastic products	25
Manufacture of other non-metallic mineral products	26
Manufacture of basic metals	27
Manufacture of fabricated metal products	28
Manufacture of machinery and equipment n.e.c.	29
Manufacture of electrical and optical equipment	30-33
Manufacture of transport equipment	34, 35
Other manufacturing	36
Recycling	37
Electricity and gas supply	40
Water supply	41
Construction of buildings	45.2.1.1, 45.2.1.3, 45.2.2
Civil engineering	45.2.1.2, 45.2.3, 45.2.4
Building installation and completion	45.25, 45.3, 45.4, 45.5
Trade and repair of motor vehicles/cycles	50
Wholesale trade (excl. motor vehicles/cycles)	51
Retail trade and repair (excl. motor vehicles/cycles)	52
Hotels and restaurants	55
Land transport	60
Water transport	61
Air transport	62
Supporting transport activities	63
Post and telecommunications	64
Banking	65
Insurance and pension funding	66
Activities auxiliary to financial intermediation	67
Real estate activities	70
Renting of movables	71
Computer and related activities	72
Research and development	73
Legal and economic activities	741
Architectural and engineering activities	742
Advertising	744
Activities of employment agencies	745
Other business activities	74.3, 74.6-74.9
Public administration and social security	75
Defence activities	75.2.2
Subsidized education	80
Health and social work activities	85
Sewage and refuse disposal services	90
Recreational, cultural and sporting activities	92
Private households with employed persons	95
Other service activities n.e.c.	91, 93

Annex 2: Industrial categories distinguished in the new waste accounts.

Waste types (eural code)	Dangerous (h) or non-dangerous (n-h)	Households	Agriculture, forestry and fishing 01-05	Mining and quarrying 10-14	Manufacturing 15-37	Electricity, gas and water supply 40-41	Construction 45	Trade and repair, hotels and restaurants 50-55	Transport 60-64	Sewage and refuse disposal services 90	Other services 65-99 (excl. 90)	Total domestic production	Import	Total supply	Absorption: Recycling	Absorption: Incineration	Export	Contribution environmental theme: Landfill
Spent solvents (01.1)	h	0	15	3.567	267.248	41	694	13.754	2.390	2.625	5.073	295.409	20.811	316.220	114.129	120.812	81.275	4
Acid, alkaline or saline wastes (01.2)	h	0	15	916	79.770	519	154	2.545	1.251	395	3.694	89.259	3.577	92.836	8.058	338	79.448	4.992
	n-h	0	8	10	1.771	1	4	145	17	141	62	2.158	0	2.158	1.282	12	0	863
Used oils (01.3)	h	0	1.693	568	19.367	580	2.009	30.201	7.248	1.091	4.651	67.408	3.215	70.623	38.406	2.638	29.529	50
Spent chemical catalysts (01.4)	h	0	0	10	3.882	0	1	161	0	561	9	4.623	0	4.623	749	58	3.685	132
	n-h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical preparation waste (02)	h	0	187	2.551	38.272	85	2.953	7.095	2.038	4.724	12.563	70.467	1.501	71.968	25.035	17.338	28.618	977
	n-h	0	2	0	17.017	3	79	560	251	66	893	18.871	1	18.872	10.510	2.938	0	5.424
Chemical deposits and residues (03.1)	h	0	335	1.919	9.619	61	481	4.457	8.711	764	1.727	28.074	12.145	40.220	254	13.474	26.480	12
	n-h	0	3	8	165.440	65.303	56	387	1.977	36	1.500	234.709	0	234.709	172.168	53.366	0	9.175
Industrial effluent sludge (03.2)	h	0	21	15.861	28.451	32	6.648	1.288	52.740	1.176	120	106.337	57	106.394	34.146	24.353	35.264	12.631
	n-h	0	197	734	171.833	76	617	6.190	2.559	11.465	941	194.612	0	194.612	142.046	31.796	11.440	9.330
Health care and biological wastes (05)	h	0	17	0	328	0	9	278	3	19	6.388	7.043	1.519	8.562	0	8.562	0	0
	n-h	0	0	0	1	0	0	0	39	1	2	43	0	43	0	43	0	0
Metallic wastes (06)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ferro (06.1)	n-h	0	0	0	12.886	0	0	0	0	3.350	0	16.236	0	16.236	16.236	0	0	0
non-ferro (06.2)	h	0	0	0	68	0	0	0	0	0	0	68	0	68	66	0	3	0
	n-h	0	0	0	23	0	55	433	1	0	122	634	0	634	588	46	0	0
mixed (06.3)	h	0	0	0	69	0	1	48	43	5	7	172	24	196	184	0	0	12
	n-h	11.393	0	177	68.733	0	0	14.472	2.832	1.593	10.277	109.477	19.155	128.632	99.382	0	29.250	0
Glass wastes (07.1)	h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n-h	348.304	0	0	106.816	0	0	46.216	1.002	167	29.058	531.564	0	531.564	526.709	2.656	0	2.199
Paper and cardboard wastes (07.2)	n-h	818.637	3.244	0	664.531	0	0	334.333	46.203	1	220.100	2.087.048	0	2.087.048	1.785.540	13.640	285.585	2.282
Rubber wastes (07.3)	n-h	110.537	0	0	1	0	0	242	0	0	34	110.814	0	110.814	110.814	0	0	0
Plastic wastes (07.4)	n-h	1.297	9.385	9	53.961	1	19	15.649	2.254	74	7.445	90.093	0	90.093	66.384	6.621	11.890	5.198
Wood wastes (07.5)	h	0	21	0	0	0	0	1.373	868	3.591	1.339	7.191	18.207	25.398	358	148	24.786	106
	n-h	225.877	0	2.003	444.637	0	0	66.894	32.047	6.597	37.054	815.109	0	815.109	5.739	308.923	500.235	212
Textile wastes (07.6)	n-h	31.854	0	0	19.372	0	1	667	0	14	1.878	53.787	128	53.915	40.425	6.501	4.611	2.378
Waste containing PCB (07.7)	h	0	0	0	328	881	12	3	37	16	142	1.419	1.735	3.154	240	2.792	122	0
Discarded equipment (08)	h	287.878	170	66	2.793	102	1.419	26.302	1.507	1.932	6.862	329.030	1.425	330.455	248.462	4.655	40.274	37.063
	n-h	90.776	0	0	407	0	7	3	1	0	18	91.211	27.376	118.587	93.502	9.628	5.880	9.577
Waste of food preparation and products (09.1)	n-h	1.342.760	1.768.064	1	6.151.582	0	39	38.096	3.103	8.049	26.060	9.337.755	3.361	9.341.116	8.224.114	913.561	86.129	117.312
Green waste (09.2)	n-h	379.064	0	0	1.051.693	0	0	0	0	627.009	0	2.057.765	16.055	2.073.820	2.030.176	31.042	764	11.838
Animal faeces, urine and manure (09.3)	n-h	0	2.047.470	0	184	0	0	0	0	0	0	2.047.654	37.891	2.085.545	1.821.973	12.943	250.629	0
Household and similar wastes (10.1)	n-h	4.631.732	0	4.013	691.489	7	0	1.045.387	149.302	370.469	907.393	7.799.792	599	7.800.391	1.209.519	5.465.548	8.495	1.116.829
Mixed and undifferentiated materials (10.2)	h	0	9	0	451	1	0	5	4.475	9	22	4.972	0	4.972	534	75	4.336	27
	n-h	5.970	11	1	600.070	217	14	84.345	94.886	2	91.387	876.904	58	876.962	378.348	9.034	486.006	3.574
Sorting residues (10.3)	h	0	0	0	33.565	0	1.687	24.224	36.872	53.678	35.228	185.255	0	185.255	122.361	2.474	4.748	55.673
	n-h	0	0	0	127.458	0	0	0	0	136.899	0	264.358	0	264.358	0	0	264.357	1
Waste water treatment sludge (11.1)	n-h	0	0	4	70.175	0	0	54	0	343.998	0	414.230	2.087	416.317	61.696	221.685	121.364	11.572
Sludge purification drinking and process water (11.2)	n-h	0	0	0	3	25.581	0	0	0	0	0	25.584	3.529	29.113	23.638	0	0	5.475
Dredging spoils (11.3)	n-h	0	0	34.554	0	0	5.763	0	0	4.541	34.807	79.664	0	79.664	41.033	0	0	38.631
Cesspit contents (11.4)	n-h	0	0	0	250	0	5	3	1	7.606	10	7.875	0	7.875	3.214	1.047	0	3.614
Construction and demolition waste (12.1)	h	0	555	149	9.087	16	6.432	8.583	6.626	42.794	3.330	77.571	14.086	91.657	57.427	15.152	0	19.079
	n-h	91.574	0	1.003	752.514	0	23.789.689	0	908	346	0	24.636.034	0	24.636.034	22.806.001	80.339	1.118.157	631.537
Asbestos waste (12.2)	h	16.078	302	65	1.422	339	10.672	1.459	2.425	6.150	8.687	47.598	105	47.703	112	25	108	47.458
Mineral wastes (12.3, 12.5)	h	0	1	962	18.142	26	4.444	570	840	1.339	2.794	29.119	0	29.119	20.664	521	0	7.935
	n-h	468.796	37	149.183	1.165.201	23.079	7.559	1.679	23.012	47.009	53.418	1.938.973	705	1.939.678	1.414.591	9.558	241.281	274.248
Combustion waste (12.4)	h	0	0	203	71.886	11.544	0	177	206	157.582	2.804	244.403	190.930	435.333	152.295	35.191	9.404	238.443
	n-h	0	0	0	2.331.903	1.379.070	919	3	0	873.805	2	4.585.702	0	4.585.702	4.467.301	288	104.053	14.060
Contaminated soils and polluted dredging spoils (12.6)	h	0	4	7	7.222	0	8.856	1.086	160	2.952	16.659	36.946	90.229	127.175	40.252	6	81.731	5.186
TOTAL		**8.862.526**	**3.831.769**	**218.542**	**15.261.921**	**1.507.565**	**23.851.298**	**1.779.365**	**488.833**	**2.724.642**	**1.534.560**	**60.061.022**	**470.511**	**60.531.533**	**46.416.663**	**7.429.824**	**3.979.936**	**2.705.109**

Table 6.6: Supply and use of residuals, 2003.

Remarks:
The views expressed in this paper are those of the author and do not necessarily reflect the policies of Statistics Netherlands.

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