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Statistics on pre-treatment of waste

Pilot study - Norway 2004

Division for Environmental Statistics

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Final report to EUROSTAT

Abstract:
Sorting of waste is the most important pre-treatment operation in the Norwegian waste handling industry. About 23 per cent of all registered waste undergoes sorting. Therefore, we recommend that EUROSTAT should focus on sorting as one of the central pre-treatment operations if the waste statistics is to be extended to include also pre-treatment operations. This report discusses matters concerning pre-treatment of waste and presents results from present surveys from the Norwegian waste handling industry.

Keywords:
waste, preparatory treatment

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Summary

The purpose of this report is to identify preparatory treatment operations in waste handling, with particular regards to the types of preparatory treatment that can be useful for identifying double counting in the waste statistics. The study is in accordance with the objectives stated in the Terms of Reference for the pilot study.

The report starts with an introduction to the scope and objective of the project, and continues with a discussion on preparatory treatment operations. Some recommendations on which types of treatment that should be included in future waste statistics are given, and we pay particular attention to the importance of sorting in the waste handling process. Important aspects in the discussion are feasibility of obtaining data, in addition to the costs and benefits of the reporting. This section also includes a table with pre-treatment operations according to the R and D codes from the Waste Statistics Regulation and Doc. WASTE/WG/44/5.3.2.

A rather thorough description of the survey and the methodology used is provided. We believe that our experiences and knowledge can be of benefit for others who are conducting similar surveys. Some attention has been given to the development of the questionnaire, which is an important part of the survey. We have included an overview of the questions that relate to double counting.

Results are presented, both general results on treatment of waste and a separate section on preparatory treatment operations. In order to get a good understanding of the issues involved in this pilot study, we believe that knowledge of the general results is important, but we focus on the preparatory treatment operations. One important result from the survey is that 835 000 tonnes of waste undergoes sorting, which constitutes about 23 per cent of all waste reported.

The final part of the report presents our recommendations for conducting similar surveys, as well as more general conclusions on preparatory treatment operations. Again, we emphasize the importance of sorting in the Norwegian waste handling system, and the need for this reporting.

1 Introduction

In the Waste Statistics Regulation, the waste treatment methods are mentioned in Annex II, but a clear description of these operations is not given. This is particularly true for possible preparatory treatments of waste. As stated in the Terms of reference for the present study: "a clear description is needed of the kind of operations to be included, the products they deliver and which operations could lead to double, or more, counting of the waste streams". Therefore, the main focus of this report will be a presentation of the preparatory treatment operations applicable to the Norwegian waste handling industry, as well as a discussion on feasibility and cost-effectiveness issues regarding the collection of data for these operations.

We have also given a thorough description of the survey conducted in connection with this project, with emphasis on issues concerning the reporting and consecutive revising. In order to obtain quality data on preparatory treatment of waste, it is advisable to address these issues in a comprehensive way.

Some conclusions are made, particularly on the types of preparatory treatment operations that should receive particular attention. In relation to the Norwegian waste handling system, we have found that sorting is the operation that is by far the most important, and will be our main proposal for further development of the statistics.

2 Preparatory treatment operations

2.1 Relevant types of preparatory treatment operations

Our main focus in the study has been to assess the possibilities of obtaining data on preparatory operations, as defined in Annexes II.A and II.B of Directive 75/442/EEC. The directive has a rather broad interpretation of the term, and includes both general treatment operations and more specialized treatments like recovery of components from catalysts (R8). This leaves the member countries with some room to emphasize the operations they find most relevant for their national setting.

We have decided to focus on the types of preparatory treatment that can be defined as first-hand treatment, meaning that this type of treatment is a prerequisite for further treatment. In our opinion, sorting is the most important type of general treatment operation in this sense. It is a possible preparatory treatment for all mixed waste, and it is a requirement for further material recovery and thereby contributes to reduction of waste for final treatment. As an example, sorting as preparatory treatment before incineration will increase the rate of recovery for some fractions, but it is not a requirement for utilization of the waste. Data on sorting will enable us to look at the effect of the current emphasis on waste issues, in order to reduce the amount of waste for final treatment.

We expect sorting plants to dominate the pre-treatment segment of the Norwegian waste treatment sector. Due to increased environmental concern and pressure for increased material recovery, this type of activity has been encouraged over the recent years. In addition to centralized sorting plants, households in many municipalities have been sorting more of their waste in recent years. Household sorting has mostly focused on paper waste, but to an increasing degree also biodegradable waste, glass and metal waste. There has also been an increased focus on recovery of different beverage containers in plastic or metal, which is sorted at the supermarkets where they can be delivered in reverse vending machines. Our statistics does not cover the sorting done outside of the dedicated sorting plants and will underestimate the effort put in to this type of operation.

There are a number of other pre-treatment operations that could be included, but with some exceptions, they are more specialized and apply only to certain types of waste. One example of a more general type of treatment is pre-treatment for final composting. Some material needs to be grinded and in some cases it is necessary to add a firmer material in order to get a good structure on the compost. One can argue that these kinds of treatments are preparatory, as they are necessary or at least preferable for the final composting process, but are not necessarily an integrated part of a composting plant.

The more specialized types of pre-treatment include sterilizing of biodegradable material for further processing as food for livestock and poultry. A slightly similar treatment is the de-inking of print colour from paper before the paper is recycled. This treatment facilitates the use of recycled paper for finer types of paper products. These kinds of treatments have a common feature in that they do not significantly alter the amount of waste, and are therefore not relevant for the problem of double counting in the Norwegian Waste Statistics. By measuring the amount of waste at the point of entering the final treatment, we do not have to take these kinds of preparatory treatment into consideration.

Wood waste can be sent directly to incineration, but will in many cases undergo a process of grinding and even producing fuel briquettes consisting of grinded and moulded wood waste. This simplifies the handling and transportation of the waste to incineration plants. In most cases, this pre-treatment also enhances the degree of energy utilization since the incineration process will be more effective. It is appropriate to mention drying of sludge in the same context, but this is in most cases done prior to disposal.

The following table is in accordance with the objectives stated in the Terms of Reference, and gives an overview of the preparatory treatment operations we have identified in the present study. Thus, the proposal given here on the classification of these operations are based on the Norwegian waste handling situation and reflects the legislative, technical and other features of the waste handling industry in Norway. Preferably, this should be supplied with proposals from other European countries in order to represent a complete classification system.

Table 1: Summary of preparatory treatment methods applicable to codes in the Waste Statistics Regulation, as stated in the Terms of Reference for the pilot study

R and D codes	Which (consecutive) pre-treatment methods are included?	Which kinds of facilities are included?	Kind of waste treated?		Kind of 'products'
			Waste treated	Secondary waste generated	Secondary raw material
R1	Sorting, grinding of wood, production of fuel briquettes	Sorting plant	All kinds of waste, including material suitable for incineration	Non-flammable waste	Waste for incineration
R3	Sorting, composting, fermentation for biogas production, de-inking	Sorting, composting, biogas plant	All kinds of waste including biodegradable and other organic waste	Composting residues, mostly non-organic and plastic material. De-inking sludge	Soil improver, material for landscaping, fertiliser
R4	Sorting, shredding	Sorting plant, shredder	All kinds of waste	Mixed and undifferentiated materials	Scrap metal and other metal compounds suitable for recycling
R5	Sorting, grinding	Sorting plants, grinding mill	All kinds of waste	Mixed and undifferentiated materials	Plastic, glass and other inorganic materials suitable for recycling
R10	Sorting, composting, grinding	Composting, biogas and sorting plants	Biodegradable waste	Composting residues	Material from composting suitable for soil improvement etc.
R12	Sorting				
D1	Drying of sludge				
D2	Drying of sludge				

For operations D1 to D12, blending or mixing prior to submission (D13) would be a relevant pre-treatment operation. Similarly, repackaging prior to submission (D14) would be relevant for operations D1 to D13, as would storage (D15) pending any operations numbered D1 to D14. However, since these operations do not alter the amount of waste and cannot be seen as environmental measures, they are not relevant for this discussion. Biological or physic-chemical treatment and treatment of hazardous waste are not the focus of this study, in which case numbers D5, D8, D9 and R6-R9 can be ignored. Similarly, use of wastes obtained from R1-R10 (R11) can be ignored for the reasons stated in Doc. WASTE/WG/44/5.3.2 p. 32. Incineration at sea (D11) is obsolete due to several international agreements that ban this practice.

2.2 Issues regarding cost-effectiveness and feasibility of data collecting

We have chosen to disregard some pre-treatment operations prior to several disposal operations. In addition to the arguments mentioned above, the question of cost-effectiveness will be a common factor in assessing which operations to include in the reporting. The extent of preparatory treatment of waste that is sent for disposal is not as relevant for environmental purposes as the amount of waste is the same whether it is pre-treated or not. It is evident that collecting data on such operations should not be our main focus.

As stated earlier, different sorting methods are the most important preparatory treatment in the present statistics on Norwegian waste handling. This treatment can be involved prior to many types of recovery operations of non-hazardous waste. Specialized sorting plants exist, and as our survey has shown, it is possible to obtain data on the amounts of waste processed in this way. In order to identify double counting, it is particularly important to obtain data for this type of operation.

Drying of sludge has been mentioned as a possible pre-treatment for disposal operations D1 and D2. The sludge originates from wastewater treatment plants and is given this treatment to facilitate disposal, either for landfills or land treatment. Due to the fact that data for sludge from wastewater is already available, it is our opinion that this type of pre-treatment could be reported with a relatively small effort.

3 Survey methodology

3.1 Data sources

Collection of data regarding waste treatment operations was conducted as a census survey. The total population of waste treatment operations was identified as follows. We produced lists of plants that had reported data to Statistics Norway in previous surveys. Then the environmental representatives at the County Governors offices were asked to either include additional plants or exclude plants in these lists. They were also asked to check for correct addresses, before reporting back to Statistics Norway. The lists updated by the County Governors were then used as the basis for defining the total population for the survey.

The County Governors are the governmental body that has the most current information on plant status, since many waste management plants need to obtain a permit from the County Governors in order to operate. Any plant with a permit is obliged to report any spills or pollution from their operations. The permit applies to landfills and incineration plants, but not necessarily composting and

sorting plants. The latter two will be included in the registers if they are located in conjunction with plants that hold a permit, while the rest may be covered by other sources of information. The County Governors and Statistics Norway have a good general knowledge of composting and sorting plants, although knowledge of specific plants may be somewhat arbitrary. Due to the possibility that some plants are not registered through these sources, the total number of plants and thereby the amount of waste treated, may be higher than reported here.

The register of plants is stored as a part of the Central Register of Establishments and Enterprises (CRE). We intend to use CRE as a source of information in the future, mainly for covering the plants that are not included in the present survey. By crosschecking our lists of plants against lists of enterprises in the relevant NACE categories, we can verify whether some plants have been left out. The advantage of the CRE is that it is frequently updated, and is easily accessible through internal systems at Statistics Norway. At present, the level of detail concerning the NACE-classification is not sufficient for identifying the different kinds of plants through this register, but we expect future developments will enable us to use this approach.

The reporting system KOSTRA (Muncipal-State-Reporting) is one of our main sources for other types of data regarding waste and waste treatment. We are considering ways of using this system for reporting new or closed-down plants, since we expect a decentralized reporting to be more accurate on this matter, although it would be more elaborate. The reason is that we believe municipality officials may have better oversight over the local waste-handling situation than the County Governors, particularly in the larger counties.

3.2 Development of the questionnaire

The primary objective of this project was to compile statistics on first-hand treatment of non-hazardous waste in Norway for 2003. A special focus was put on identifying the waste that undergoes several treatments during the process. In many cases, this can lead to problems of double counting in the statistics. While statistics for each operation in the treatment process is vital for the broader picture, it is important to distinguish between final and transitional processing of waste. Classification of the different treatment operations has been in accordance with Annex II, section 8(2) in the Waste Statistics Regulation (WSR).

The questionnaire had to incorporate the most important categories of recovery and disposal operations. In this way, the questionnaire could be used for all types of plants without any special adaptations for disposal, incineration or composting plants. In addition, several plants incorporate different types of treatment operations, which is another reason for this approach. Waste from several activities is often weighed in the same part of the plant, and in some cases weighed or calculated for transfer from one activity to another within the plant.

Table 2: Material categories in the waste statistics in accordance with Annex II, section 8(2) in the Waste Statistics Regulation (WSR)

Category in Norwegian Waste Statistics	Code in the WSR
Paper and cardboard waste	07.2
Glass waste	07.1
Plastic waste	07.4
Metal waste	06
EE-waste	08.4
Biodegradable waste	09.1+09.3
Wood waste	07.5

Gardening waste	09.2
Textile waste	07.6
Concrete and bricks	12.1+12.2+12.3+12.5
Hazardous waste	Several categories
Mixed and undifferentiated materials	10.2
Other waste	

In the questionnaire, we asked the plant to report data for the waste categories listed in table 2, both if the plant received sorted waste and if the plant sorted the waste according to these categories themselves. This gives us a more complete picture of the waste stream entering and exiting the plant. The level of detail is important for analytical purposes, as the types of waste have different characteristics in terms of possible recovery.

The importance of identifying double counting has been a main concern in the development of the questionnaire. In order to avoid this problem, we had to include fairly detailed questions about the origin of waste and what treatment it received at the plant. Such detailed questions may lower the quality of the statistics, as the questionnaire becomes more time-consuming to fill in, and respondents may not have all the information readily available. Nevertheless, we believe that our approach is an important step towards the elimination of the problem. Table 3 gives some of the central questions and the purpose for which each question was included in the survey. The questionnaire is shown in the appendix.

Table 3: Questions in the survey relating to double counting

Question	Purpose
How much waste originated from other plants?	Keeps track of the amount of waste that is registered twice or more
How much waste was only repackaged or temporarily stored?	This is waste that is given final treatment elsewhere than at the respondent's facilities. It can either be treated at one of the other plants in the survey, commonly sent to final treatment, or to material recovery or incineration in the industrial sector.
How much waste is transported directly to material recovery?	This is waste according to the question above, which is not pre-treated, and does not go into another plant.
How much waste was sent out of the plant for incineration?	Without pre-treatment, this waste is treated at an incineration plant either included in this survey or at an incineration plant in the industrial sector.
How much waste were residues from incineration?	This is partly waste from incineration plants that has been transported to a disposal plant and also some waste from the industry. Similarly we asked if incineration plants had disposed of such residues.
How much material was used as land treatment at the disposal plant?	This waste may be included in the total amount of waste processed in the plant, or it may not be counted as material recovery.
How much incineration residues were sorted out for	Waste that is processed in an incineration plant

material recovery?	and then sent to material recovery is not counted at any of the other plants in the survey.
How much residues from incineration got other treatment like storage, export or use as land fill?	This is waste that is processed at an incineration plant and then treated further by another plant.

The questions in table 3 help to identify the streams of waste, and thereby enable us to calculate the net totals in the cases where waste is treated in multiple processes. We have focused on using simple and straightforward terminology in order to avoid problems of interpretation. By asking for specific amounts for each type of treatment and each possible source of double counting, we simplify the task for the respondents, and provide a more detailed data material.

Some waste is processed in a sorting plant, either mechanically sorted or sorted systematically by hand. This waste may then be further processed in a different plant, for material recovery or incineration, domestically or abroad. For this reason, we included a set of questions specifically for sorting plants, focusing on what happened to the waste after it had gone through pre-treatment. These questions gave us a good picture of the overall secondary treatment operations, and the role played by sorting plants. It is shown in table 4.

Table 4: Waste streams after sorting

Secondary treatment	Plant included in the survey	Incineration in industrial plant	Export
Material recovery		x	x
Incineration w/energy recovery	x	x	x
Landscaping landfills	x	x	
Biological treatment	x		
Disposal	x		

The table shows that there is some uncertainty connected to incinerated waste, since this waste may be processed at plants that is not included in the survey. There is a possibility that the waste may be exported or processed at other domestic facilities. Still, these questions give a good understanding of the sorting process, and which types of plants that receive the sorted material.

Sorted waste was also reported by material categories, according to table 1. This information has a general value for the waste accounts, and especially for further research and analysis. We also asked for some specific technical information regarding all plants in the survey.

3.3 Revision and implementation of the survey

All plants received the questionnaire by mail, with information on the possibility to use electronic reporting. As mentioned, this was based on an MS Excel-platform. Around 50 per cent of the plants chose to use the system for electronic reporting.

Respondents were given relatively short time to complete the questionnaire, due to some delays in the preparation phase. Three weeks after the mailing date, around 30 percent of plants had reported, within

this initial due date. We sent remainders to the plants that missed the due date, partly by email and partly by telephone. By the time of publication, 92 percent of plants had responded, either electronically or by mail.

The revision was done partly manually and partly by automatic controls. An application based on MS Access was the main tool for most of the revision process. The automatic controls gave the revisers the opportunity to correct inconsistencies in data, in some cases in cooperation with the respondent. The system is user-friendly and easy to learn with helpful tutorials. For larger data sets and more extensive analysis, it may not be as adequate.

An automatic system improves efficiency to a great extent and will be continued and developed in future surveys. All tables were summarized controlled against the reported totals, which eliminated several errors. We also controlled whether the amount of waste that enters a plant is actually reported recovered or sent to further treatment. This was done in the formula: Waste weighed in = Repackaging + Composting + Incineration + Disposed on landfill + Total sorted

4 Results

Although the results from preparatory treatment of waste have been the main focus of the present project, and will form the basis for our conclusion, we have decided to provide a presentation of the general results of the survey on waste handling. Some knowledge of the Norwegian waste handling industry can be obtained from these results, which is valuable as a background for analysing the extent of preparatory treatment. The general results are particularly interesting when it comes to geographical differences in waste treatment between different parts of Norway, which is an important aspect in deciding which types of operations should be given particular attention. The plants have reported the amount of time they used for filling out the questionnaire, a total of 277 hours, or about 1 hour 15 min on average.

4.1 General results on waste handling

Data from the survey shows that energy recovery increases and the amount of waste entering landfills decreases compared to when a previous survey was conducted (2001). About 70 per cent of the energy in waste incinerated is recovered by the incineration plants, corresponding to 560 000 tonnes of waste. While the amount of waste entering incineration has doubled in the last 10 years, the amount of waste entering landfills was reduced by 30 per cent during the same time period.

Table 5: Treated waste by treatment operation.[1, 2]

	Biological treatment	*Landfill*	*Total incineration*	*Estimated fraction for energy utilization*	*Estimated fraction without energy utilization*
	1 000 tonnes	*1 000 tonnes*	*1 000 tonnes*	*Per cent*	*Per cent*
1992	21	1 687	342	73.1	26.9
1995	52	1 895	493	73.0	27.0
1998	99	1 928	470	73.0	27.0
2001	284	1 396	669	73.1	27.1
2003	277	1 202	798	70.2	29.8

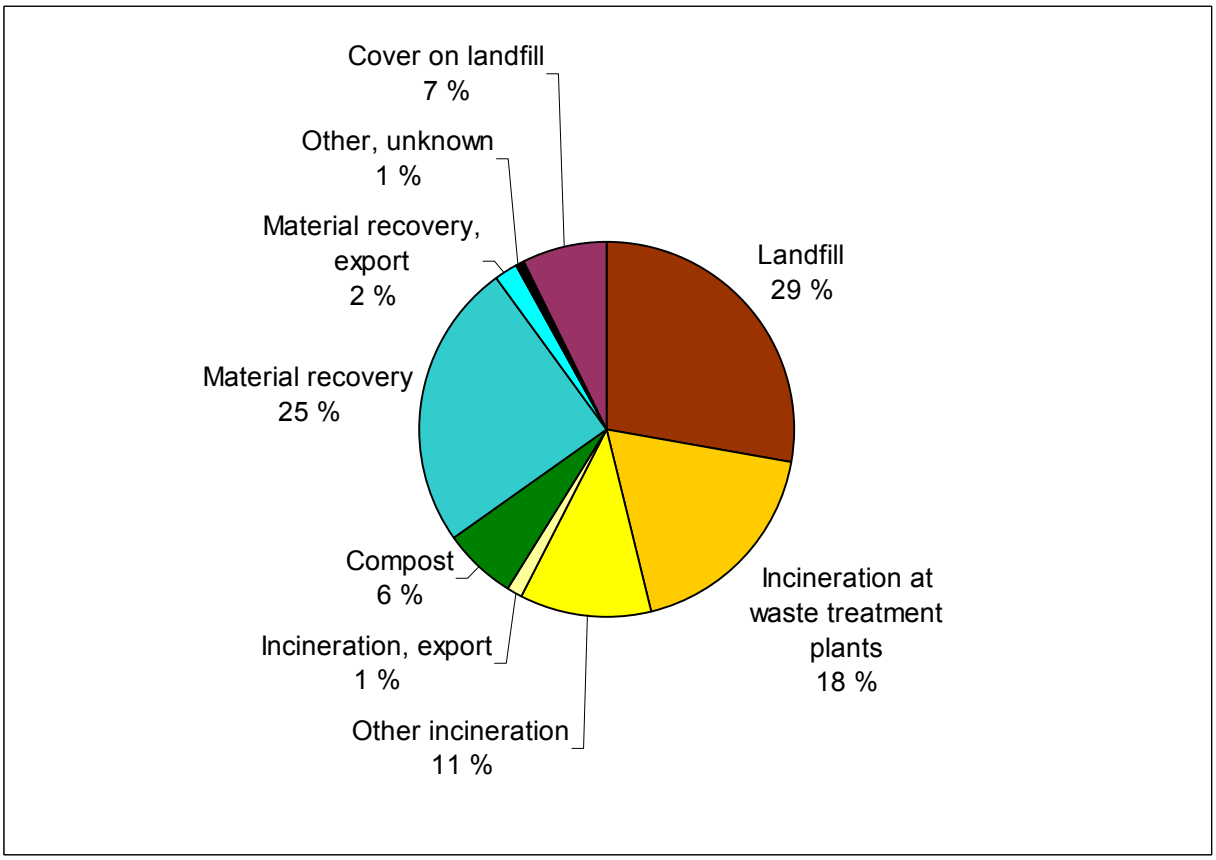
[1] Excluding waste incinerated or used at landfills by industrial local units.

[2] Waste for material recovery not included.

In 2003, the total amount of waste entering Norwegian waste treatment plants was about 3.9 million tonnes. If we compare with statistics from the Norwegian waste accounts, we find that this represents approximately 50 per cent of the total waste generated in Norway. From 2001 to 2003, the amount of waste going to final disposal, i.e. landfill or incineration without energy recovery, was reduced by 9 per cent. On-site treatment in manufacturing industries is excluded from these figures.

The tendency is towards more utilization of the possible resources embedded in the waste, in particular with regards to energy recovery. Larger cities are developing steam distribution systems for heating of private homes and public buildings, based on the heat generated from the incineration of waste. The government has initiated incentive programs to encourage this development, and the possibility of increased energy prices in the future has probably also been an important factor.

Figure 1: Waste treatment and disposal at treatment plants. 2003.



In general, a large amount of waste enters waste treatment in recyclable fractions. In 2003, 1.8 million tonnes was delivered for treatment in recyclable fractions, while 2.4 million tonnes were mixed waste. Of the 550 000 tonnes mixed waste entering sorting plants, 54 per cent is sorted into recyclable fractions.

Table 6: Landfill. Total and by county[1]. 2003. 1000 tonnes

The whole country	*Total*	*Household waste*	*Industrial waste*	*Landscaping landfills*
2001	1397	383	1013	.
2003	1202	357	845	297

The whole country	*Total*	*Household waste*	*Industrial waste*	*Landscaping landfills*
County				
01 Østfold	108	26	82	30
02 Akershus	89	27	62	38
03 Oslo	79	0	79	4
04 Hedmark	37	14	23	0
05 Oppland	62	27	35	12
06 Buskerud	134	42	92	44
07 Vestfold	18	12	6	7
08 Telemark	86	16	70	28
09 Aust-Agder	32	16	16	5
10 Vest-Agder	62	29	33	11
11 Rogaland	112	30	82	28
12 Hordaland	112	27	85	17
14 Sogn og Fjordane	30	19	11	21
15 Møre og Romsdal	59	14	45	3
16 Sør-Trøndelag	58	6	52	18
17 Nord-Trøndelag	21	10	10	9
18 Nordland	61	23	38	6
19 Troms	16	8	8	0
20 Finnmark	29	13	17	15

[1] Local industrial units may get licences for landfill on site. Such waste is excluded as well as landfilled hazardous waste.

Table 7: Waste incineration. Total and by county[1]. 2003. 1000 tonnes

The whole country	*Total*	*Household waste*[2]	*Industrial waste*	*Pre-treatment*		*Incineration residues*			
				Sorted	*Mixed waste*	*Total*	*Landfill*	*Sorted out for material recovery*	*Other*
2001	675	438	275	211	457	123	77	11	35
2003	798	544	253	223	575	197	95	11	91
County									
01 Østfold	143	..	..	65	78	22	10	1	12
02 Akershus	0	..	..	0	0	0	0	0	0
03 Oslo	299	..	..	65	233	106	49	7	50
04 Hedmark	1	..	..	1	0	0	0	0	0
05 Oppland	0	..	..	0	0	0	0	0	0
06 Buskerud	55	..	..	2	53	11	5	0	6
07 Vestfold	29	..	..	3	26	2	2	0	0
08 Telemark	0	..	..	0	0	0	0	0	0
09 Aust-Agder	0	..	..	0	0	0	0	0	0
10 Vest-Agder	0	..	..	0	0	0	0	0	0
11 Rogaland	2	..	..	2	0	0	0	0	0
12 Hordaland	100	..	..	0	100	20	3	2	16
14 Sogn og Fjordane	2	..	..	0	2	0	0	0	0

The whole country	Total	Household waste[2]	Industrial waste	Pre-treatment		Incineration residues			
				Sorted	Mixed waste	Total	Landfill	Sorted out for material recovery	Other
15 Møre og Romsdal	61	..	..	22	39	11	4	1	5
16 Sør-Trøndelag	98	..	..	59	39	23	20	0	2
17 Nord-Trøndelag	0	..	..	0	0	0	0	0	0
18 Nordland	3	..	..	2	2	0	0	0	0
19 Troms	4	..	..	0	4	1	1	0	0
20 Finnmark	1	..	..	1	0	0	0	0	0

[1]Industry companies that receive waste for incineration are not included in the statistics.

[2]Household waste is exported for incineration. Exported quantity of industrial waste for incineration is unknown.

Table 8: Composting. Total and by county. 2003. 1000 tonnes

The whole country	Waste received				Produced compost			Composting rejects
	Total	Food	Sludge	Other	Total	Fertilizer	Landscaping landfills	Landfill
2001	284	151	..	131	89	59	30	26
2003	277	112	98	68	106	92	14	7
County								
01 Østfold	12	9	0	3	7	4	3	1
02 Akershus	2	2	0	0	2	2	0	0
03 Oslo	0	0	0	0	0	0	0	0
04 Hedmark	12	8	4	0	4	3	1	0
05 Oppland	14	8	7	0	2	2	0	1
06 Buskerud	48	7	24	17	31	31	1	0
07 Vestfold	2	2	0	0	0	0	0	0
08 Telemark	6	3	2	0	1	1	1	0
09 Aust-Agder	11	5	6	0	1	0	1	0
10 Vest-Agder	28	16	12	0	12	12	0	1
11 Rogaland	50	6	13	31	15	15	0	0
12 Hordaland	28	21	7	0	10	8	2	1
14 Sogn og Fjordane	7	2	3	2	6	3	3	0
15 Møre og Romsdal	12	3	7	2	9	7	2	0
16 Sør-Trøndelag	19	0	9	10	1	1	0	0
17 Nord-Trøndelag	14	11	1	2	2	2	0	3
18 Nordland	8	6	1	1	1	1	0	0
19 Troms	5	3	2	0	1	1	0	0
20 Finnmark	0	0	0	0	0	0	0	0

In 2003, 277 000 tonnes of waste were composted, which is about 6 000 tonnes less than in 2001. The reduction in food waste is particularly large, which may be caused by less emphasis on the possibility for households to sort biological waste. A large part of composted waste comes from sludge, which is mainly produced in wastewater plants.

1.2 million tonnes of waste were landfilled in 2003, which is 195 000 tonnes less than in 2001. The reduction came in the industrial sector, while domestic waste sent to landfills increased slightly. Data seem to indicate that densely populated counties like Oslo and Akershus uses landfills to a lesser

degree, which is not surprising. Limitations on land usage, large amounts of waste and concern for local environment often leads to an extensive use of centralized incineration plants in these areas.

The amounts incinerated increased from 674 000 tonnes to 798 000 tonnes in the same period. Domestic waste is responsible for most of this increase. The counties that use incineration to the largest extent are Oslo and other counties that are densely populated. It is possible that industry processes much of its industrial waste by using their own incinerators, and on-site treatment in the manufacturing industries is excluded from these figures.

Table 9: Number of plants by treatment operation. 2003. Tonnes

	Total[1]	*Sorting, reloading*	*Composting*	*Incineration*	*Landfill*
The whole country					
1992	..	..	..	..	330
1995	..	..	..	16	274
1998	..	..	..	9	149
2001	228	184	71	20	112
2003	238	140	62	21	98
County					
01 Østfold	13	7	3	2	6
02 Akershus	14	12	1	0	6
03 Oslo	7	4	0	3	1
04 Hedmark	14	11	5	1	2
05 Oppland	7	6	4	0	3
06 Buskerud	13	8	2	2	6
07 Vestfold	10	5	1	2	3
08 Telemark	12	2	4	0	9
09 Aust-Agder	9	4	4	0	5
10 Vest-Agder	9	7	3	0	5
11 Rogaland	21	11	5	1	7
12 Hordaland	19	12	5	1	4
14 Sogn og Fjordane	11	7	5	0	5
15 Møre og Romsdal	25	15	5	2	10
16 Sør-Trøndelag	19	10	6	1	9
17 Nord-Trøndelag	7	4	2	0	2
18 Nordland	11	7	3	2	9
19 Troms	10	4	4	1	3
20 Finnmark	7	4	0	3	3

[1] Since each treatment plant may have different types of waste operation, the 'total' will not correspond to the sum of plants distributed by type of operation.

The number of landfills is reduced from 112 in 2001 to 98 in 2003. In the same period, only one new incineration plant was introduced. In 2003 the number of registered incineration plants came to 21 compared with 20 in 2001. It is also interesting that the number of sorting plants dropped from 184 to 140. In some cases, the reduction in the number of plants may be caused by the introduction of larger and more efficient plants, resulting in smaller plants closing down.

4.2 Details on preparatory treatment and double counting

In the survey on waste treatment, the amounts of waste treated differ from the amounts of waste generated. The latter amounts are published in the Norwegian Waste Accounts, while the first amounts are published in this report. Both sources of data are representative, but characterize different aspects of the waste situation in Norway that may be equally interesting. In this report however, we have

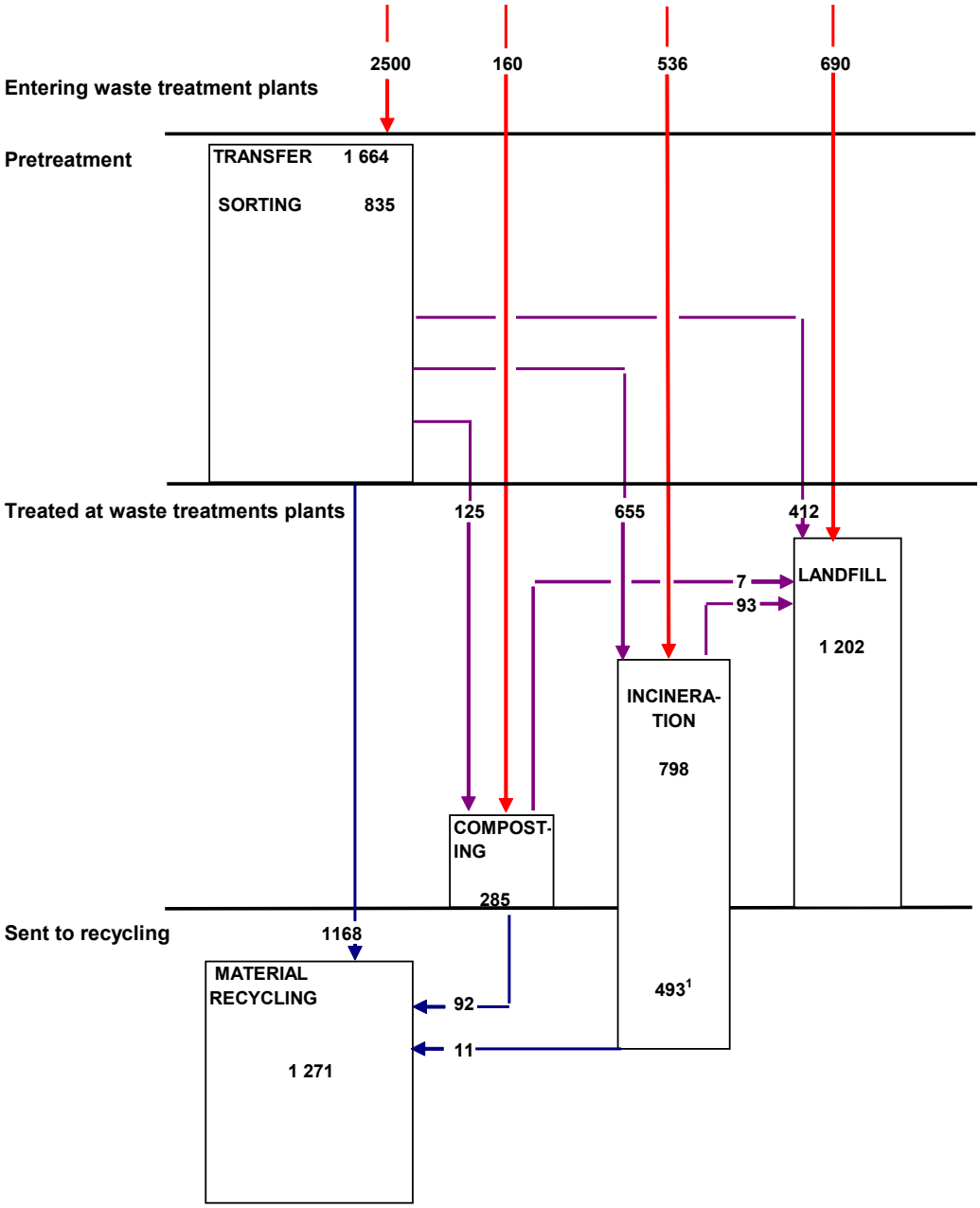
focused on details in waste handling, and in particular the possibilities for double counting. By identifying the waste streams between different types of plants, we can illustrate these details. Figure 2 shows the waste streams from the point where they enter a waste treatment plant, through pre-treatment and secondary treatment. Some waste is incinerated outside of the plants in the survey, while all material recovery takes place in plants not included in the survey. Waste weighed in at the plants is marked red, and amount to 3.9 million tonnes. The amount weighed out of the plants is 1.7 million tonnes, while 1.3 million tonnes have been treated at more than one type of plant in our sample of treatment plants.

Sorting at the source of waste generation, either household or commercial business is becoming more and more common. This type of sorting effort will not be included in these results, but contribute to the pure material going into composting, incineration and landfill. We also expect there to be considerable recycling effort connected to household sorting that is not included in our data, this refers to the types of material that is sent directly to recycling plants.

It is important to note that the material flows that is shown to enter the incineration plants and landfills consists both of pure material sorted at the source of waste generation as well as mixed waste. In some cases, the material that goes to incineration is exclusively flammable and recoverable material, while in other cases it consists of several different types of waste. The flow of waste that goes to composting is on the other hand purely biodegradable and similar material.

Some assumptions have been made. One example is the amount of waste for incineration, which is not adjusted for energy recovery; we have counted net amounts as they enter the incineration plant. A second assumption is that composting is seen as a separate type of treatment and residues from the composting process is defined as waste for material recovery. Some of the soil from composting is used for landscaping landfills, and in some cases also sent to ordinary landfills. It is also important to be aware that due to temporary storage from one year to another, the amounts of waste weighed in are not necessarily identical to the amounts weighed out.

Figure 2: Waste disposal at waste plants. 2003. 1000 tonnes.



[1] This is waste sent to on-site incineration in the industrial sector. The calculated amount is provisional, and is probably overestimated.

As we can see from figure 2, most waste that enters the pre-treatment plants does not undergo sorting. Around 3 million tonnes or about 77 percent of all waste is sent to main treatment without sorting. Some 1.4 million tonnes enters the main treatment directly; this is mostly for landfill and incineration. About 1.2 million tonnes is sent to material recycling, and approximately the same amount is put in landfills. Very little material is recovered from the incineration residues; some of these residues are treated in landfills.

This means that 23 per cent of all waste undergoes some kind of sorting, either in a specialized sorting plant or in a separate process in plants that also performs any of the main kinds of treatment. The range of sorting methods is wide, and includes mechanical sorting of metals, plastic and several other materials. It is obvious that sorting represent an important part of the waste handling, as the tables 10 and 11 also show.

While 140 plants sort out waste to some degree, only 57 of these are specialized sorting plants where the waste undergoes a mechanical sorting process. Other plants have a more irregular sorting of certain materials, for example wood materials at disposal plants. Table 10 shows that the sorting ratio is about 57 per cent. This indicates that sorting is in many cases a prerequisite for recycling operations and it is possible that the large extent of sorting has contributed to a higher recovery ratio, both in terms of material and energy.

Table 10: Mixed waste pre-treated at sorting plants, by type of material after sorting. Per cent

Total	100
Paper and board	11
Glass	0
Plastic	2
Metals	12
Electrical/electronic waste	1
Biodegradable waste	2
Wood waste	8
Park and gardening waste	1
Textiles	0
Concrete and bricks	3
Hazardous waste	0
Other	16
Residual waste	43

Metals account for 12 per cent of total sorted waste, a relatively large fraction if we deduct residual waste from totals. The sorting process is probably simpler than for some other materials, and it is also likely to be more demand for metals in recycling plants. Paper sorting is also quite common, as the Norwegian paper industry in many cases utilizes the recycled material.

Table 11: Mixed waste pre-treated at sorting plants, by type of material and treatment after sorting. Per cent

	Total	*Material recovery and recycling*	*Incineration w/ energy utilization*	*Landfills for landscaping*	*Biological treatment*	*Deposited*	*Other/ unknown*	*How much was exported?*
Total	100	26	32	7	4	25	6	14
Paper and board	100	82	1	0	0	0	17	8
Glass	100	60	0	0	0	0	39	0
Plastic	100	65	6	0	0	0	28	4
Metals	100	77	0	0	0	0	23	0
Electrical/ electronic waste	100	43	0	0	0	0	57	2
Biodegradable waste	100	0	2	0	90	0	8	0
Wood waste	100	33	50	1	12	0	3	19
Park and gardening waste	100	63	7	0	30	0	0	0
Textiles	100	0	0	0	0	0	100	0
Concrete and bricks	100	48	0	46	0	6	0	0
Hazardous waste	100	22	65	0	0	8	5	11
Other	100	4	80	15	0	0	0	25
Residual waste	100	0	35	6	1	58	0	18

Table 10 gives a good picture of what happens to the waste after sorting. Naturally, the main treatment depends on type of material, while 82 per cent of paper and board waste were used for material

recovery, almost 50 per cent of concrete and bricks were used as landfill for landscaping. Overall, many types of materials are sent to material recovery, but incineration with energy recovery is still the most important treatment for mixed waste as a whole.

If we look at the fraction of waste that is being reused at domestic plants, this varies from 100 per cent for park and gardening wastes to 0 per cent for textiles. Overall rate is 69 per cent, and most materials have a rate between 60 and 100 per cent. This rate is calculated from the sum of material recovery, incineration with energy recovery, landscaping and bio-treatment.

5 Evaluation and recommendations for future surveys

For coming surveys, we hope to develop a web-based reporting system. A letter will be sent to the respondents with an identity number and a PIN-code, much like other web-based systems where users need to identify themselves. The solution is based partly on the current development of a uniform reporting system at Statistics Norway, so that respondents have a single website for all types of surveys. Another reason for introducing a web-based system is that the present electronic reporting is based on MS-Excel files, which tend to create problems for some respondents with a firewall system that disable macros.

The respondents misunderstood some questions, this is particularly true for the part regarding total amount of waste weighed out of sorting plants. The reason is that another question asked for further treatment of repackaged waste, and respondents seem to be confused about the difference between the questions. For next years reporting, we will improve this by clarifying the differences between the two categories in a better way.

One way of simplifying the reporting for the plants is to ask for the amounts weighed in and out at the plant, by material. Such data is more readily available for the respondents, as this is the way they measure their own productive process. When we combine this information with type of plant, we will obtain similar data as before. In addition, we will also try and obtain information on the further treatment of waste that is weighed out of the plant. We will keep the questions concerning double counting.

All questions related to waste from industry, quarrying and mining will be taken out in next year's survey, but we will ask plants to indicate which type of business the waste originates from. In some cases it can be difficult for the plants to determine the exact amounts, in which case we will ask them to indicate the fraction for each type of business. We will also supplement this with some basic questions included in an existing survey of the industry.

We intend to use data obtained in this survey for development and improvement of the Norwegian waste statistics. The fact that this survey gives us better understanding of how the waste is treated, and what types of plants are involved, makes this data a valuable tool for progress in the field of waste statistics and waste modelling in Norway.

6 Conclusion

Preparatory treatment operations are an important part of the waste handling process, which in itself justifies detailed reporting on this matter. In addition, this reporting can aid in the elimination of double counting in the waste statistics, which has been a major point of interest for this study. We believe that the reporting of these operations will provide important information on the waste handling in Europe.

However, the need for detailed statistics will have to be weighed against cost issues concerning the collection of these data, in addition to actual feasibility of obtaining the required data. In our study, we have focused on sorting as the most important preparatory treatment in the Norwegian waste handling industry, and the results from our survey confirms the extent of this type of operation. About 23 per cent of all waste is pre-treated in this way, which is a considerable fraction. Plants used on average 1 hour 15 minutes on the reporting, which does not constitute a great cost for the enterprises.

It also has to be emphasized that sorting is a pre-treatment for several important recovery operations, and plays an important part in the utilization of energy and material. As geographical and legislative differences between EU countries may lead to other conclusions in other countries, our recommendation is that this type of treatment will be given particular attention.

7 References

Waste treatment statistics for Norway, online article Dec. 8. 2004, Statistics Norway: http://www.ssb.no/english/subjects/01/05/avfhand_en/

The Norwegian Waste Accounts, online article Jan. 20. 2005, Statistics Norway: http://www.ssb.no/english/subjects/01/05/40/avfregno_en/

Guidance on the classification of waste treatment methods, Manual for the Waste Statistics Regulation. Doc. WASTE/WG/44/5.3.2 EUROSTAT/European Commission

Waste Framework Directive Annex II.A and II.B of the Council Directive of 15 July 1975 on waste (75/442/EEC)

Appendix

A: Questionnaire used in the survey. English version can be provided upon request.

Statistisk sentralbyrå
Statistics Norway

Returadresse:
Seksjon for miljøstatistikk
Statistisk sentralbyrå
2225 Kongsvinger

Svarfrist:
26. mars 2004

Oppgaveinnhenting for avfallstatistikk 2003.

AVFALLSHÅNDTERING

Rapportering fra deponier, forbrenningsanlegg, komposteringsanlegg og sorteringsanlegg

Opplysningene som er etterspurt i dette skjemaet kan også rapporteres elektronisk til oss.
Skjemaet er laget i excel og vil bli sendt dere med E-post. Utfyllt skjema sendes oss i retur som vedlegg til E-post.

Ta gjerne kontakt hvis det oppstår spørsmål eller usikkerhet under utfyllingen av skjemaet.

Saksbehandlere i Statistisk sentralbyrå:

Eva Vinju,
E-post: eva.vinju@ssb.no
Tlf. 62 88 54 76

Barbara Kupis Frøyen
E-post: barbara.kupis.froeyen@ssb.no
Tlf. 62 88 51 29

Skjemaet har en generell del som fylles ut av alle.
Resten av skjemaet er inndelt etter typen aktivitet som foregår på anlegget.
For de fleste vil det si at bare en liten del av skjemaet skal fylles ut, mens de som har flere typer aktivitet må fylle ut flere av spørsmålene.

Opplysninger om anlegget

Er det feil i navn eller adresse? Skriv inn riktige opplysninger her

Anleggets navn			
Anleggets eier			
Adresse			
Postnummer		Poststed	
Kommunenummer		Kommune	

Hvem skal kontaktes hvis SSB har spørsmål til avfallsselskapet?

Navn, kontaktperson	
Stilling	
E-post	
Telefon	

RA-0478

Avfallsmengde veid inn i 2003. Fylles ut for alle anlegg.

Tonn

1 **Hvor mye avfall ble veid inn på hele anlegget i 2003?**

2 **Hvor mye av innveid avfall.....**

Tonn

- kom fra andre avfallsanlegg (ikke miljøstasjoner)?.....
- kom fra industri?.....
- kom fra bergverk og utvinning?.....
- var slam?.....

For 2003 vil SSB produsere egen statistikk for næringene *Industri* , *Bergverk* og *Utvinning* . Vi ber dere derfor kun oppgi tall for disse næringene her. Annet næringsavfall skal ikke spesifiseres. Hvis tall ikke finnes, ber vi dere anslå etter beste evne

3 **Fordel innveid materiale fra spm 1, på reine fraksjoner og blandet restavfall i første kolonne. Svar deretter på tilleggsspørsmålene i de 4 neste kolonnene.** Definisjoner og veiledning finnes på eget ark

Norsk standard for avfall(NS 9431)		**Tonn i alt**	**Hvor mye av dette stammet fra industri, bergverk og utvinning? (Her kan det anslås)**	**Hvor mye av dette ble kun omlastet eller mellomlagret?**	**Hvor mye av dette ble sendt direkte til material-gjenvinning?**	**Hvor mye av dette ble sendt ut av anlegget for forbrenning?**
				Tonn		
1200	Papir, papp, kartong og drikkekartong					
1300	Glass					
1700	Plast					
1400	Metaller					
1500	EE-avfall					
1111-1125	Våtorganisk avfall					
1141-1149	Treavfall					
1131	Park- og hageavfall					
1911	Tekstiler					
1611 - 1614	Betong og tegl					
7000	Farlig avfall					
	Annet					
9999	Blandet restavfall					

Spesifiser annet:

.

Fylles ut for komposteringsanlegg og biogass-anlegg

	Kompostering (aerob biologisk behandling)	Biogassbehandling (anaerob biologisk behandling)	
4 **Hvor mye avfall ble levert til kompostering?.....**			Tonn
5 **Hvor mye av avfallet ved innveiing var.....**			
- matavfall?.....			Tonn
- avløpslam?.....			Tonn
- annet?.....			Tonn
- fra industri?.....			Tonn
- fra bergverk og utvinning?.....			Tonn

	Tonn
6 **Hvor mye ferdig kompost ble brukt som.....**	
- vekstmedium?.....	
- dekkmasse?.....	
7 **Hvor mye siktrester ble lagt på deponi?.....**	

Fylles ut for forbrenningsanlegg

	Forbrenning med energiutnyttelse	Forbrenning uten energiutnyttelse	
8 **Hvor mye avfall ble forbrent?**			Tonn
9 **Hvor mye av avfallet kom fra...**			
- industri?			Tonn
- bergverk og utvinning?			Tonn

10 **Hva var utnyttelsesgraden for energien fra anlegget?**		Prosent
11 **Hvor mye forbrenningsrester....**		
- ble lagt på deponi?		Tonn
- ble utsortert for materialgjenvinning?		Tonn
- fikk annen behandling (lagring, eksport, dekkmasse o.l.)?		Tonn

Fylles ut for avfallsdeponier

Her skal alt avfall som ble lagt på deponi i 2003 føres opp, også rester fra eget sorteringsanlegg, komposteringsanlegg eller forbrenningsanlegg

12 **Hvor mye avfall unntatt dekkmasse ble lagt på deponi?**		Tonn
13 **Hvor mye dekkmasse ble brukt på deponiet?**		Tonn
14 **Hvor mye av avfallet...**		
- kom fra industri?		Tonn
- kom fra bergverk og utvinning?		Tonn
- var forbrenningsrester fra forbrenningsanlegg?		Tonn

15 **Hvor mye ble deponert av følgende typer farlig avfall i 2002 og 2003:**

	2002	2003	
Asbest (inkl. eternitt)?			Tonn
Oljeslam?			Tonn
Forurenset blåsesand håndtert som spesialavfall? (Avfallsstoffnummer 7096 eller EAK12 02 01 / EAL120116)			Tonn
Kromholdig slam fra f.eks. garverier?			Tonn

16 **Ble sigevannet fra deponiet samlet opp i 2003?**

- ☐ Ja → 17 **Hva slags behandling fikk sigevannet?**
  - ☐ Renset i eget anlegg
  - ☐ Renset i annet anlegg
  - ☐ Ikke renset
  - ☐ Både/og
- ☐ Nei

18 **Ble det tatt ut gass fra deponiet i 2003?**

- ☐ Ja
- ☐ Nei

Fylles ut for sorteringsanlegg, og andre anlegg som sorterer ut enkeltmaterialer.

Informasjon om hva som skal føres opp:

- Hvis dette er et **spesialisert sorteringsanlegg** skal alt avfall, også restavfall etter sortering tas
- Hvis det gjelder **sporadisk utsortering** på deponi eller forbrenningsanlegg, eller avfall fra miljøstasjoner og som befinner seg inne på området, føres bare de reine fraksjonene opp, mens restavfall kun føres på spørsmål 12 eller spørsmål 8

19 Fylles bare ut av spesialiserte sorteringsanlegg

Hvor mye av innveid avfall til sorteringsanlegget stammet fra.....

- Tonn
- bergverk eller Tonn

Fylles ut både av spesialiserte sorteringsanlegg og for sporadisk utsortering

20 **Fordel sortert materiale på reine fraksjoner i første kolonne. Spesialiserte avfallsanlegg fører også opp restavfall etter sortering. Før deretter opp avfallet under den behandlingsmåten det fikk videre, i de neste kolonnene.**

Definisjoner og veiledning finnes på eget

	I alt utsortert nærings- og husholdnings-avfall på dette anlegget	Material-gjenvinning og ombruk	Forbren-ning m/energ-utnytting	Brukt til dekk-masse	Biologisk behandling	Deponert	Annet/ Ukjent	Hvor mye av avfallet ble eksportert?
	Tonn	Tonn						
Papir, papp, kartong drikkekartong								
Glass								
Plast								
Metaller								
EE-avfall								
Våtorganisk avfall								
Treavfall								
Park- og								
Tekstiler								
Betong og tegl								
Farlig avfall								
Annet								
Restavfall etter sortering								

Spesifiser annet:

Spesifiser annet, bruk gjerne kommentarfeltet i tillegg:

Tidsforbruk og kommentarer

21 **Hvor lang tid tok det å fylle ut skjemaet. Regn også med tiden det tok å hente fram dataene:** Minutter

22 **Kommentarer:**

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2005/5 L. Hobbelstad Simpson: National Accounts Supply and Use Tables (SUT) in Current Prices. SNA-NT "SUT/STARTER"

2005/6 S. Todsen: SNA-NT User's Guide for Supply and Use Tables in Current and Constant Prices.

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2005/8 H.V. Sæbø: Metadata strategy in Statistics Norway. Eurostat Metadata Working Group Luxembourg, 6-7 June 2005.

2005/9 J.L. Hass, K.Ø. Sørensen , K. Erlandsen and T. Smith: Norwegian Economic and Environment Accounts (NOREEA). Project Report 2002.