Statistics Norway
Statistisk sentralbyrå

Statistics Norway
Department of Economic Statistics

Håkon Skullerud, Øystein Skullerud and Svein Homstvedt

Documents

Pilot study: Treatment of Hazardous Waste

Final report to EUROSTAT

Division for Environmental Statistics

Håkon Skullerud, Øystein Skullerud and Svein Homstvedt

Pilot study: Treatment of Hazardous Waste

Final report to EUROSTAT

Acknowledgement:
This action has received funding from the Commission of the European Communities, represented by EUROSTAT. Contract No. ESTAT 200471200025.

Address:
Håkon Skullerud, Statistics Norway, Division for Environmental Statistics, Oterveien 23, 2225 Kongsvinger

Abstract

Hazardous waste represents a serious environmental and health risk if handled illegally. This report focuses on strategies for collecting data, which may serve as a basis for estimating the amount of hazardous waste handled illegally. Also, collecting of data on pre-treatment of hazardous waste for other purposes is discussed.

The report gives a thorough description of the data collection method used in this project and discusses some practical impacts of using a survey approach versus a method completely based upon register data. A recommendation for the choice of data collection method is given based on coverage, cost effectiveness, feasibility of getting good data and versatility of the collected data.

The report also discusses alternative ways of reporting data on pre-treatment of hazardous waste and which pre-treatment operations to be included in the reporting to the WStatR. One main conclusion from the pilot study is that data on pre-treatment of hazardous waste should be given as net weight changes. Thereby, both a data basis for the estimation of hazardous waste handled illegally and comparability of hazardous waste treatment statistics among the member states are ensured.

The main results from this pilot study are: 1) Pre-treatment accounts for 8 per cent of all final treatment of hazardous waste in Norway. 2) Double counting of hazardous waste due to forwarding of hazardous waste treatment products for further treatment/disposal equals 3 per cent of the collected amount of hazardous waste in Norway.

Treatment operations rendering the hazardous waste non-hazardous are defined as final treatment in this study, also those giving a non-hazardous treatment product going to further waste treatment/ disposal. Pure collectors of hazardous waste with sorting, mixing, repacking, etc. as their only operation methods were not included in the study as they were assumed to contribute with only minor weight changes to the waste. Forwarding of non-hazardous treatment products was not reported.

Table of contents:

1 Introduction

The Waste Statistics Regulation (WStatR) requires the member states (MS) to compile statistics for the different treatment operations mentioned in Annex II, section 8 (2) (based on the R&D codes). These codes cover a number of pre-treatment operations (sorting, certain chemical preparatory procedures etc.). Thus, double counting will most likely occur because the waste undergoes several successive treatments.

This project is set up to assess this double counting, try to determine ways to avoid it and assess the weight reductions stemming from pre-treatment operations for hazardous waste. The report will also contain tables covering all kinds of hazardous waste treatment in Norway and a comparison of amounts of treated hazardous waste assessed in this project and amounts to approved treatment registered by the environmental authorities. Based on the findings in this study, there will be given recommendations for future reporting on pre-treatment of hazardous waste to EUROSTAT.

The main part of the project was a questionnaire survey of hazardous waste handling operators in Norway. Additional data were collected from alternative sources. Some preliminary work was done prior to the project period, including planning the project, developing the questionnaire, identifying the potential respondents and evaluating alternative data sources. The remaining work, which was covered by this project, includes:

- Part 1: Distribute the questionnaires
- Part 2: Receive the completed questionnaires
- Part 3: Collect data from alternative data sources
- Part 4: Data revision
- Part 5: Statistics development and compiling (including developing necessary data tools)
- Part 6: Publish the results (internet and written report).

The reference year is 2003.

2 Definitions

The survey focused on the treatment/disposal of hazardous waste exclusively. Therefore, operators handling non-hazardous waste were not included in the survey. The definitions below are adapted to that.

Treatment: Final treatment + pre-treatment.

Final treatment (of hazardous waste): Incineration (R1 and D10), recovery (R2 to R10) and all kinds of treatment rendering the hazardous waste non-hazardous. Requires license for treatment.

Pre-treatment (of hazardous waste): All handling operations changing the waste's weight/volume or hazardous waste classification, rendering the waste still hazardous and followed by sending the treatment product to another enterprise for further treatment. The heaviest pre-treatment operations (e.g. D8 and D9) require license for treatment.

Collection (of hazardous waste): Handling operations including light pre-treatment operations making no or minor changes to the wastes weight or hazardous nature (e.g. D13 and D14). Requires license for collecting and intermediate storing.

Disposal: D1 to D7, D12.

Hazardous waste groups: Norwegian codes for classifying hazardous waste by material. The codes are defined in appendix1, table 1 and consist of the two middle digits of the NS9431 code.

Hazardous waste is counted as finally treated/disposed of at an enterprise if all the hazardous parts are recovered, rendered non-hazardous or disposed of, regardless of how the non-hazardous parts are handled. Similarly, hazardous waste is counted as pre-treated at an enterprise if all the hazardous parts are sent to another enterprise for recovery, etc. If some of the hazardous parts are finally treated/disposed of at an enterprise and some are forwarded to another enterprise for further

treatment/disposal, only the hazardous part treated/disposed of at the first enterprise is counted as finally treated/disposed of, while the remaining hazardous parts and all the non-hazardous parts are counted as pre-treated.

3 Methodology

3.1 The hazardous waste survey

3.1.1 Population

About 320 different enterprises have been registered as hazardous waste operators in Norway since 1997. About 200 of these enterprises are landfills designed for ordinary waste but with permission for certain types of hazardous waste[1]. Since landfills for ordinary waste were already covered by a survey of ordinary waste (included in Agreement No. ESTAT 200471200024), they were excluded from the hazardous waste survey and instead, the survey of ordinary waste was extended with a few simple questions of how much of each type of hazardous waste being land filled. This reduced the remaining population to about 120 enterprises.

The remaining population could further be divided into two categories: 1 - Recovery/disposal operators and 2 - collectors. Collectors are enterprises only slightly changing the hazardous waste's weight/volume and classification by for instance draining water from oil/water-mixtures and repacking hazardous waste into bigger packaging. The benefit of including the collectors in the survey was therefore judged not to exceed the burden for them to respond to the survey. The pure collectors were therefore excluded from the survey, reducing the hazardous waste survey population to 59 enterprises.

The survey covered hazardous waste operators exclusively. Hence, handling of non-hazardous waste treatment products were not covered by the survey. Neither was the use of recovered wastes (R11).

3.1.2 Questionnaire

The questionnaire (appendix 3) had five main foci, which were served by the following efforts (table 1):

[1] One or more of the following: Asbestos, oil sludge, contaminated blasting grit and sludge containing chromium.

Table 1: Main foci and efforts of the hazardous waste survey questionnaire (appendix 3).

Focus	Effort
Make general statistics on how the hazardous waste is treated/disposed of in Norway.	Question 4: How much hazardous waste was disposed of or recovered at the enterprise in 2003?
Calculate the weight reductions due to pre-treatment.	Question 3 - (question 4 + question 5). Question 3: How much hazardous waste was received from Norwegian enterprises or private persons in 2003? Question 5: How much hazardous waste was forwarded to another enterprise for further treatment/disposal in 2003? Double counting of non-hazardous waste was not surveyed.
Make a list of all pre-treatment operations employed in Norway, to investigate if there are some pre-treatment operations not included in the R&D codes.	Question 7: What pre-treatment operations were employed at the enterprise in 2003, and for what hazardous waste groups? The respondents were asked to state the pre-treatment operations in free text. In the questionnaire instructions, pre-treatment was defined as a "process changing the waste's weight/volume or classification, and where the treated waste is still defined as hazardous waste."
Calculate the double counting due to forwarding of treated hazardous waste for further treatment/disposal.	Question 5.
Evaluate how well the system for registration of hazardous waste going to an approved treatment/ disposal works. This registration makes a basis for the estimation of hazardous waste to unknown (and possibly illegal) handling in Norway.	Difference between question 3 and question 5.

In addition, the questionnaire contained the following questions:

- Question 1 and 2: Filter questions to exclude enterprises irrelevant for the survey and to avoid double reporting of data.
- Question 6: Help getting a complete population and revising the data.
- Question 8: Used for calculating the amount of hazardous waste incinerated with and without energy recovery respectively.
- Question 9: Used to monitor the response burden.

The data from the survey were combined with the data from alternative sources to make a complete picture of treatment/disposal of hazardous waste in Norway (see below).

The survey employed Norwegian systems for classifying the hazardous waste by material type and treatment/disposal. The system for classifying by material type (appendix 1, table 1) is an aggregation of NS9431, while the system for classifying by treatment/disposal is also built on NS9431, but with some adaptations to cover typical hazardous waste treatment methods.

The reasons for choosing the Norwegian material classification were: 1) Data according to the Norwegian system are readily available by the respondents. 2) The data translates into EWC-stat rev.3 by means of the methodology developed in EUROSTAT project 200271200005 (Conversion tables for hazardous waste).

The reasons for choosing the Norwegian treatment classification were: 1) The Norwegian treatment classification combined with the Norwegian material classification is in most cases sufficient for converting to the R&D codes relevant in Norway. A converting table is given in appendix 1, table 2. 2) The classification used covers most hazardous waste treatment activity in Norway. 3) Considerations of space in the questionnaire.

All tables in this report are according to EU classification.

3.1.3 Data collection and revision

The questionnaires were available both as a paper version sent by mail and on the Internet as an Excel-file. Prior to the distribution of the paper questionnaires, a contact person at the operator was identified. The paper version was sent via the head office to the contact person. The address to the Internet version of the questionnaire was printed on the paper questionnaire.

All 59 respondents answered the survey. 41 answered by mail and 18 answered on the Internet. Total response burden was 43.6 hours. The Excel-file was also used as a tool for punching the data on the paper questionnaires. There are some problems frequently encountered when collecting data by an Excel-file. Some respondents have old versions of Excel with insufficient functionality. Some respondents are refused to open the Excel-file because the macros in the file are rejected by the data security system at the operator. Also, it took quite long time to open the Excel-file (approximately 2 to 4 minutes). This may have reduced the number of respondents answered by Internet. In future surveys a standard Internet portal will be used.

The data were revised by comparing the collected amount to the treated and forwarded amount, and by comparing the data to the corresponding data for 2002. The revision was all manual, and was accomplished by telephone contact. Totally, 10 operators were contacted.

3.2 Alternative data sources

From 2002, Statistics Norway collects data on the use of waste oil for fuel in a survey of energy statistics. To avoid double reporting, operators having incineration of waste oil for fuel as their only recovery/disposal operation, were asked to indicate this in the questionnaire instead of reporting amounts. Data from these operators were subsequently collected from the other survey. However, all incineration plants in the population were asked to report the percentage of energy recovered from the waste.

To make a complete picture of the recovery/disposal of hazardous waste in Norway, hazardous waste disposed of at the site of generation, and export of hazardous waste, were included in the statistics. These hazardous wastes are reported to the pollution control authorities and put into annual databases, which are subsequently delivered to Statistics Norway on request. The disposal operations reported to the database concerning hazardous waste disposed of at the site of generation are not classified according to the R&D codes. Therefore, a translation had to be done.

Table 2: Data sources for the treatment of hazardous waste in Norway.

Description of data source	Number of enterprises	Data collection method	Unit responsible for data collection
Enterprises specialized for the treatment of hazardous waste	49	Survey (treatment/disposal of hazardous waste)	Statistics Norway, Division for Environmental Statistics
Landfills designed for ordinary waste	Ca. 200	Survey (treatment/disposal of non-hazardous waste)	Statistics Norway, Division for Environmental Statistics
Enterprises using waste oil for fuel	40 [1]	Survey (energy statistics)	Statistics Norway, Division for Energy Statistics
Enterprises treating their own hazardous waste (excluding waste oil)	11	Reporting	Norwegian Pollution Control Authority (SFT)
Enterprises exporting hazardous waste	33 [2]	Reporting	Norwegian Pollution Control Authority (SFT)

[1] 10 enterprises in the hazardous waste survey population and 30 enterprises outside the hazardous waste survey population covering 94 per cent and 6 per cent of the incinerated waste oil respectively.

[2] 6 enterprises in the hazardous waste survey population and 27 enterprises outside the hazardous waste survey population covering 6 per cent and 94 per cent of the exported hazardous waste respectively.

For comparison, the Norwegian declaration database (a national database containing ideally all hazardous waste deliverances to authorized treatment plants in Norway each year) for the reference year was collected and aggregated. This database makes a basis for the estimation of hazardous waste to unknown (and possibly illegal) handling in Norway.

3.3 Data processing

The Excel-file used as electronic questionnaire on the Internet, was also used for punching and systematizing the data from the hazardous waste survey. For processing the data from all the different sources into appropriate tables, a SAS®-program was developed (appendix 3). Some finishing was done in Excel.

4 Discussion

4.1 General information

4.1.1 Policy needs for statistics on waste undergoing pre-treatment

There are at least three aspects that may generate a need for statistics on pre-treatment of hazardous waste:

1) Hazardous waste handled illegally may cause serious environmental and health problems. Estimates on hazardous waste being handled illegally are therefore an important part of the statistics on handling of hazardous waste (maybe the most important). These estimates cannot be made without reliable statistics on hazardous waste collected for approved handling.

   In Norway statistics on hazardous waste collected for approved handling have been made from register data (the declaration database, treatment/disposal at own plant and export, see alternative data sources above). These data sources make a reliable basis for developing statistics on hazardous waste collected for approved handling, given an effective reporting and registration system. These data sources also provide the opportunity of splitting the statistics on hazardous waste by industry, as the identity of the originate establishment is reported together with the hazardous waste data.

   However, for countries not having such registration system, the investments required in establishing such a system are extensive. As an alternative, statistics on hazardous waste collected for approved handling may be developed based on a survey among hazardous waste operators. Because pre-treatment may affect the hazardous waste's weight/volume by for instance dewatering or vaporisation, and alter the material composition, the survey must include pre-treatment operations. This project presents a comparison of statistics from the two alternative procedures.

2) Every member state is committed by the Basel convention to ensure that all hazardous waste generated within the country is handled without causing health or environmental risks and to minimize export of hazardous waste. Statistics on handling of hazardous waste may be an instrument for monitoring the national handling capacity and identify possible bottlenecks in the chain of operators. Pre-treatment is a natural part of this picture, as it is a necessary preparation for the final treatment/disposal. However, since a specific hazardous waste may be treated/disposed of through different treatment/disposal chains, it may be difficult to estimate the necessary capacity in each link of the chain.

3) In all waste there are resources, which may be utilized if the waste is handled properly. Statistics on pre-treatment of hazardous waste may contribute to the general picture of how the resources in the hazardous waste are utilized.

The first of these aspects seems to be the most important reason for compiling statistics on pre-treatment of hazardous waste, due to environmental considerations and the feasibility of making relevant statistics. However, if statistics on hazardous waste collected for approved handling shall be comparable to statistics on total generated amount of hazardous waste, and thus give an estimate on the amount of hazardous waste treated illegally, *pre-treatment operations must be counted as net changes in weight/volume and classification*. Weight/volume reductions should be given a positive sign and weight/volume increases a negative one. A change in classification should be counted as a positive amount of the original code (weight reduction) and a negative amount of the new code (weight increase).

The second is also important as a political instrument to ensure sufficient treatment/disposal capacity. However, it is difficult to know what pre-treatment capacity being necessary for handling a certain amount of hazardous waste, as there are alternative treatment/ disposal methods involving a different number of consecutive treatment/disposal steps. It is thus difficult to make reliable comparisons from statistics on generated amount of hazardous waste and statistics on available treatment/disposal capacity. However, if expressing pre-treatment as a change in weight/volume and classification, statistics on generation of hazardous waste and statistics on final capacity available for treatment/disposal would be quite comparable.

The third aspect seems the least important with respect to pre-treatment, as most resources are utilized in the final link in the treatment/disposal chain.

4.2 Specific information

4.2.1 Discussion on and suggestion for pre-treatment operations that should be included in the WStatR

According to the general discussion above, the pre-treatment operations that are most important to include in the WStatR, are those giving changes in the waste's weight/volume or classification. Accordingly, reporting of waste handled according to the code R12 seems to be redundant. Also, handling according to the codes D13 and D14 seem to be of minor importance, but can reveal changes in the waste classification. Reporting according to code D15 and R13 may reduce uncertainty in the statistics on weight/volume changes due to pre-treatment, but may cause excessive response burden or pour data quality due to lack of registration by the operator.

On the other hand, the findings in our study suggest that one pre-treatment operation, which is not covered by the R&D-codes in the WStatR, should be included with a new code. This pre-treatment operation is *mechanical separation*. An example of that is the separation of PCB-containing windows into glass and frame. The glass with the PCB-containing glue is still hazardous, while the frame is regarded as non-hazardous.

Additionally, one treatment operation could be discussed further. *Treatment of contaminated wastewater* (e.g. LoW 190106) results in the release of clean water to a water body and in some cases, a residual that must be treated as waste. If there is no residual, the treatment must be regarded as final, and possible codes could be D6 and D7. However, it is not obvious that clean water released to a water body should be regarded as waste, and consequently, the operation of releasing water to a water body cannot be given a code for treatment/disposal of waste. The water treatment itself should then be given a separate code. This code should not be D8 or D9, as these codes imply the generation of a treatment product requiring further processing or disposal. Instead, there should be established a new code for treatment of wastewater defined as hazardous waste. Contrary, if the wastewater treatment generates a residual that must be further treated/disposed of, the operation must be regarded as pre-treatment. However, this does not require a second code for treatment of wastewater to be introduced, provided that pre-treatment is reported as the net change in weight/volume and classification.

A preliminary recommendation is to include wastewater treatment as a separate code, which cover both treatment operations giving a treatment residual and treatment operations not giving a treatment residual. Further studies could be considered.

4.2.2 Suggestion for methods of assessing double counting due to forwarding of waste treatment products

Double counting of hazardous waste may be easily calculated from data on amounts of waste products forwarded for further treatment/disposal. In this study only the double counting of hazardous treatment products is included, and only a selection of hazardous waste operation methods is surveyed. However, the principle of collecting the data is the same. In Norway data on forwarded waste treatment products are readily available at the operators. Note should be taken that forwarding of hazardous treatment products affects the estimation of illegally handled hazardous waste, while forwarding of non-hazardous treatment products does not.

4.2.3 R&D codes for pre-treatment operation in the WStatR - relevance of reporting and distinction from final treatment.

Table 3 below shows the different pre-treatment operations employed in Norway, together with a suggested R&D-code and the waste types for which the operations are employed. The description of the pre-treatment operations, as given by the respondents, has been standardised.

Table 3: Pre-treatment operations employed in Norway in 2002 and 2003.

Pre-treatment operation	Suggested R&D-code	EWC-stat3 codes
Electrolysis for recovery of silver	R4 or D9	1.2
Evaporation	D9	1.1; 1.2; 1.3; 3.1; 8; 8.41; 12.4
Neutralising	D9	1.2; 2; 3.1; 12.1+12.2+12.3+12.5
Partitioning/milling	D13	1.1; 1.2; 1.3; 2; 3.1; 12.1+12.2+12.3+12.5
Precipitation	D9	1.1; 1.2; 2; 3.1; 12.4
Separation (biological)	D8	1.3; 3.1; Wastes from oil drilling [1]
Separation (filtration)	D9	1.1; 1.2; 1.3; 2; 3.1; 12.4; Wastes from oil drilling [1]
Separation (heating)	D9	1.3; 3.1; Wastes from oil drilling [1]
Separation (mechanical)	D-code, new	7.7; 8; 8.41
Separation (oil/water separator)	D9	1.3; 3.1
Separation (sedimentation)	D9	1.2
Separation (unspecified, dewatering)	Unspecified, mostly D9	1.3; 3.1; 12.4; Wastes from oil drilling [1]
Stabilising (by chemical reaction)	D9	1.2; 2; 3.1; 12.1+12.2+12.3+12.5
Unspecified (biological)	D8	1.1
Unspecified (chemical)	D9	Wastes from oil drilling [1]
Wastewater treatment	D-code, new	1.3; 3.1; 12.4; Wastes from oil drilling [1]

Most of the pre-treatment operations reported in the questionnaire were easily converted to an R or D code. The R&D codes that most frequently applied to the different pre-treatment operations reported in the hazardous waste treatment survey were D8 and D9. The codes D13 to D15 and R12 to R13 were almost absent. This is not very surprising, as collectors, whose most typical handling operations are the D13 and D14 operations, were excluded from the survey population and changes in the waste stock were not reported separately. The operations D13 to D15 and R12 to R13 are not defined as treatment in Norway, but handling. Changes in weight/volume and classification due to D13 to D15 and R12 to R13 operations are discussed in relation to table 6.

It might be discussed if there should be introduced a separate set of P-codes for pre-treatment operations instead of the present R and D codes. This would be an option if operators performing a pre-treatment operation are not required to know what the final treatment/disposal operation would be. It is left for further study to investigate this possibility.

The distinction between pre-treatment and final treatment/disposal was in this study made by subtracting the amount of hazardous waste finally treated/disposed of from the amount of hazardous waste collected for treatment/disposal. Note that the definition of final treatment in this study was broader than in the WStatR, as only hazardous waste operators were included in our survey. Operations rendering the waste completely non-hazardous according to the WStatR, were defined as final treatment in this study, even if the non-hazardous treatment product was regarded as waste and had to be forwarded for further treatment/disposal. In future surveys, forwarding of treatment products

being non-hazardous waste will be included as a separate question, and the definition of final treatment will be in accordance with the WStatR.

An alternative way of distinguishing pre-treatment from final treatment/disposal is to define as pre-treatment only the treatment operations generating a treatment product being a waste and sent for further treatment/disposal to another operator, and to define as *integrated* operations all operations generating a treatment product being a waste and treated/disposed of by the operator itself. The integrated operations could then be classified by their final operation. This alternative would, however, lead to a loss of information. Therefore, it is recommended that pre-treatment operations being reported, also when the treatment product is finally treated/disposed of by the same operator. An exception from this would be integrated operations where the different operation steps are inseparable.

Both these alternatives may give rise to uncertainty due to variations in the operators' waste stock. An increase in the waste stock will be counted as weight reduction due to pre-treatment and a decrease in the waste stock will be counted as weight increase, unless the stock variation is reported separately. In this study, the operators were not asked for data on stock variations.

Table 4: Proposals for identification and descriptions of pre-treatment operations to be included in the WStatR

Pre-treatment operation	Description
Operations that should be included:	
D8	Description in the WStatR is ok.
D9	Description in the WStatR is ok.
Mechanical separation	Mechanical treatment not specified elsewhere in this Annex, which results in final compounds or mixtures that are discarded by means of any of the operations numbered D1 to D 12 (e.g. dismantling, cutting, etc.).
Operations that should be considered:	
Wastewater treatment [1]	Any treatment of wastewater defined as hazardous waste according to the WStatR, which results in the release of clean water to a water body and possibly a residual that are treated by means of any R or D operation.
D13	Description in the WStatR is ok.
D14	Description in the WStatR is ok.
D15	Description in the WStatR is ok.
R13	Description in the WStatR is ok.

[1] Both pre-treatment and final treatment operation. Should be included if D8 or D9 followed by D6 is not an appropriate alternative.

According to the discussion in section 4.2.2, if operators performing pre-treatment operations are not required to know what the final treatment/disposal operation would be, it should be considered to introduce a separate set of P-codes for pre-treatment operations.

5 Results

Table 5 shows the amount of hazardous waste treated in Norway. The total is not corrected for double counting due to consecutive treatment operations. Pre-treated waste is expressed as net weight changes. All figures are given in tonnes.

Table 5: Hazardous waste in Norway by material and handling[1]. 2003. Tonnes.

EWC-stat rev. 3	Total[2]	R1	R2 - R9	D1	Other/ unspecified	Pre-treatment	Export	Forwarded hazardous waste
Total	809 143	75 446	51 468	233 594	279 920	64 925	76 686	27 106
1.1	16 945	2 348	136	76	851	-251	13 517	269
1.2	272 804	771	7 015	40 589	199 163	4 225	18 720	2 323
1.3	70 650	43 274	187	928	83	7 995	2 761	15 423
1.4	2	0	0	1	0	0	0	0
2	16 708	9 271	112	164	1 943	-3	4 563	659
3.1	42 002	10 231	540	7 090	5 848	10 828	3 408	4 057
3.2	7 210	1 057	124	1 655	1 249	2 059	611	454
6	193	8	2	0	136	18	7	22
7.5	227	14	0	147	32	8	26	1
7.7	896	1	0	12	0	646	204	33
8	2 142	253	495	434	13	349	356	243
8.41	29 799	2	246	19 610	4 788	1 207	3 763	183
10.2	330	2	9	50	243	3	22	1
10.3	1	0	0	0	0	0	0	0
12.1+12.2+12.3+12.5	156 587	2 660	0	106 021	23 178	5 962	18 167	598
12.4	84 651	62	0	54 067	16 395	3 582	10 212	332
12.6	312	60	3	90	0	97	38	24
Wastes from oil drilling[3]	104 708	5 432	42 599	0	25 998	28 200	0	2 479
Unknown	2 976	0	0	2 660	0	0	311	5

[1] Data are aggregated due to confidentiality.

[2] Not corrected for double counting.

[3] Norwegian supplements to the LoW not included in the EWC-stat Rev. 3.

Pre-treatment operations account for 8 per cent of the total final disposal of hazardous waste in Norway. In this context, final disposal means any operation finishing the chain of hazardous waste treatment. Consequently, pre-treatment counts all hazardous waste collected but not reported as final treatment/disposal or forwarding of hazardous waste.

This amount is comparable with the amount of hazardous waste undergoing unknown handling, which was estimated to 12 per cent in 2003. If the reporting of treated/disposed amounts of hazardous waste aims at providing a reliable basis for estimates on hazardous waste being handled illegally, the reporting of pre-treatment operations as weight reductions seems mandatory.

Forwarding of hazardous treatment products gives rise to a double counting that amounts 3 per cent of the total collected hazardous waste. Thus, the double counting represents a significant source of error to the estimate on hazardous waste being handled illegally if not reported or correction is not made.

There is some uncertainty in the figures on pre-treatment operations, due to stock changes. This uncertainty is, however, assumed to balance over time.

Table 6 compares actual treatment with the registration of treatment in Norway. The treated amounts are corrected for double counting and are thus deviating from the total amount given in table 5. Pre-treated waste is expressed as net weight changes. All figures are given in tonnes.

Table 6: Treated and registered amounts of hazardous waste in Norway. 2003. Tonnes.

EWCstat rev. 3	Treated hazardous waste (corrected for double counting)	Registered amount collected for treatment/disposal	Unregistered amount collected for treatment/ disposal
Total	782 040	699 605	82 435
1,1	16 677	4 599	12 078
1,2	270 481	235 048	35 433
1,3	55 227	64 408	-9 181
1,4	1	1	0
2	16 049	13 999	2 050
3,1	37 946	51 571	-13 625
3,2	6 756	10 988	-4 232
6	172	152	20
7,5	226	270	-44
7,7	863	1 359	-496
8	1 899	1 587	312
8,41	29 617	25 429	4 188
10,2	329	294	35
10,3	1	1	0
12.1+12.2+12.3+12.5	155 989	143 291	12 698
12,4	84 319	72 586	11 733
12,6	288	247	41
Wastes from oil drilling [2]	102 229	33 152	69 077
Unknown	2 971	40 623	-37 652

[1] Only hazardous waste. Non-hazardous waste is excluded.

[2] Norwegian supplements to the LoW not included in the EWC-stat Rev. 3.

The results in table 6 indicate that about 11 per cent of all hazardous waste undergoing approved treatment in Norway are not registered by the environmental authorities.

There are some positive and some negative differences in the table. That might be a result of pre-treatment operations changing the waste's classification and excluded from the survey, e.g. D13 and D14. There are, however, also other sources of uncertainty. Stock changes (D15 and R13) might explain some of the differences, and likewise dewatering of oil/water emulsions performed by operators excluded from the survey. However, the results also indicate that the registration by the environmental authorities of hazardous waste sent for approved treatment is somewhat imperfect. Reasons for that could be insufficient revision and operators refusing or forgetting to report data to the authorities.

This suggest that more hazardous waste is generated in Norway each year than earlier assumed, and less hazardous waste is treated in an unknown and potentially illegal way. It also suggests that surveys are very useful supplements to register data regarding the estimation of hazardous waste undergoing unknown handling.

6 Conclusions and recommendations

Statistics on hazardous waste collected for approved handling can be made from register data. These data sources give detailed basic data for the statistics and allow splitting the statistics by industry. However, it does not give the opportunity of splitting the statistics on different treatment/disposal operations, which is required by the WStatR. Besides, as this study shows, basic data from registers may be somewhat imperfect, giving a rather high uncertainty to estimates on hazardous waste undergoing unknown, and thereby potentially illegal, handling. Also, for countries not having such registration system, the investments required for establishing such a system are extensive.

Therefore, data on hazardous waste collected for approved handling should be collected through a survey of hazardous waste operators. A survey is far more cost effective, and allows the statistics on

handling of hazardous waste to be split on treatment/disposal operation. It does, however, not provide data basis for extrapolations of total generated amounts of hazardous waste and splitting the hazardous waste statistics by industry.

If a survey is chosen for collecting data on handling of hazardous waste, care should be taken to avoid double reporting. In Norway, enterprises treating/disposing their own hazardous waste report the amounts to the environmental authorities annually. In such cases, the registered data should be used and the actual enterprises should be excluded from the survey. The same applies to export of hazardous waste.

The pre-treatment operations being most important to include in the WStatR, are those giving changes in the waste's weight/volume or classification. Only net changes of weight/volume should be reported, with reductions as positive figures and increases as negative ones. If classification is changed, the input amount should be reported according to the original code with a positive sign (weight reduction) and the output amount should be reported according to the resulting code with a negative sign (weight increase). This way of reporting data on pre-treatment of hazardous waste gives overall statistics on treatment/disposal of hazardous waste that are comparable with statistics on generated hazardous waste and thus makes a basis for future estimates on hazardous waste handled illegally. It also gives statistics on treatment/disposal of hazardous waste that are comparable between the member states.

In order to ensure high data quality, both collected and treated/disposed amounts should be reported. Besides of being useful for calculating the changes in weight/volume and classification according to pre-treatment, it is helpful during revision of the reported data. To avoid double counting, the amount of treatment product still being a waste and sent to another operator for further treatment/disposal should also be reported.

The most relevant R&D-codes in annex 2 concerning pre-treatment of hazardous waste are those covering pre-treatment operations changing the wastes weight/volume or altering the waste's classification. This suggests that the most important codes for reporting handling of hazardous waste to EUROSTAT are D8 and D9, while R12 seems redundant. The codes D13, D14, D15 and R13 might be excluded due to considerations of cost effectiveness and feasibility, as the exclusion of these handling operations would halve the survey population. On the other hand, the results in this study show that these operations might have influenced significantly the figures on treatment of specific waste types. Further studies should therefore be considered.

A new code for mechanical separation should be included, while a new code for treatment of contaminated wastewater should be considered. If operators performing pre-treatment operations are not required to know what the final treatment/disposal operation would be, it should be considered to change the set of pre-treatment codes into a separate set of P-codes. The coverage of the codes should be the same, except that the classification should be independent of the next treatment-step.

Though not a part of the scope for this study, illegal handling of hazardous waste should be considered given a code in the R&D code system, for which reporting to EUROSTAT was obligate.

Table 7 gives a resume of the recommendations for the specific R&D codes in appendix 2 in the WStatR and for two treatment operations not having a separate code in the present list of codes, provided a general approach of collecting data only on net changes in weight or classification. Data availability and quality is good for the treatment operations covered by this study (D8, D9, mechanical separation and wastewater treatment), and is assumed to be good also for the other hazardous waste operation methods due to license obligations on recording the waste. Total response burden is low when survey population is limited as in this study. Expanding the survey population to include D13, D14, D15 and R13 operators more than doubles the response burden. Consequently, and due to the weight changes resulting from each of the different pre-treatment operations, reporting of the pre-treatment operations D8, D9, mechanical separation and wastewater treatment should be given high priority, reporting of D15 and R13 operations should be given moderate priority, while reporting of D13 and D14 operations should be given moderate to low priority.

It should be noted that these conclusions and recommendations apply to the reporting of hazardous waste statistics. Other conclusions and recommendations may apply for non-hazardous waste.

Table 7: Data availability, data quality and response burden for different pre-treatment operation methods in Norway

R&D code	Data availability	Data quality	Total response burden	Priority
D8	Good	Good	Low	High
D9	Good	Good	Low	High
D13	Probably good (not investigated)	Good	Moderate	Moderate to low
D14	Probably good (not investigated)	Good	Moderate	Moderate to low
D15	Probably moderate (not investigated)	Good	Moderate	Moderate
R13	Probably moderate (not investigated)	Good	Moderate	Moderate
Mechanical separation	Good	Good	Low	High
Wastewater treatment	Good	Good	Low	High

References:

NS9431: Norwegian standard for classification of waste. Norwegian Standardising Union (NSF). 2000. Standard for hazardous waste classification by material is a copy of the hazardous waste numbers employed in the Norwegian hazardous waste regulation from 1994.

Alternative data sources: See table 2, page 7.

Appendix 1

Table 1: The Norwegian hazardous waste classification system. Aggregated version.

Waste group	Type of waste
1	Waste oil
2	Other wastes containing oil
3	Oil emulsions and slop water
4	Organic solvents
5	Paints, adhesives, varnish.
8	Mercury and cadmium
9	Waste containing other heavy metals
10	Cyanide
11	Pesticides
12	Isocyanates and other highly reactive substances
13	Corrosive waste
14	Waste from oil drilling and oil production
15	Organic hazardous waste not mentioned elsewhere
16	Contaminated waste water
21	PCB- and PCT-containing waste
22	Photochemicals
23	Halons
24	Chlorofluorocarbons
25	Asbestos
99	Other hazardous waste

Table 2: Treatment operations in the questionnaire and conversion to published R&D codes.

Classification in questionnaire	R&D codes
Material recovery	R2 to R9
Incineration	R1 or other/unspecified. Fraction of energy recovered used for splitting total incinerated amount into the two categories.
Biological treatment	Other/unspecified
Landfill	D1
Render non-hazardous	Other/unspecified; treatment product being non-hazardous.
Other final treatment	Other/unspecified
Not finally treated (i.e. pre-treated)	Pre-treated

Appendix 2: SAS®-program used for processing survey and additional data

```
DATA _NULL_;
 CALL SYMPUT('telleaar','2003');
RUN;

DATA spesavf.flettefil;
INPUT @01 org_nr $CHAR10.
      @11 bnr    $CHAR08.;
 CARDS;
[Business numbers, removed from the appendix due to confidentiality]
;
RUN;

%MACRO flett(org_nr);
DATA behandling_&org_nr. (DROP=stoffgr_ org_nr_);
      INFILE "X:\220\AVFALL\3 Spesialavfall\Data\behandling\Reviderte
skjema\skjema_&org_nr..txt" MISSOVER DSD PAD LRECL=820 DELIMITER='09'X
FIRSTOBS=2;
      INPUT aar      : $CHAR004.
            stoffgr_ :      008.
            navn_f   : $CHAR040.
            navn_b   : $CHAR040.
            forr_adr : $CHAR040.
            postnr   : $CHAR004.
            poststed : $CHAR030.
            org_nr_  : $CHAR009.
            person   : $CHAR040.
            tlf      : $CHAR008.
            fax      : $CHAR008.
            epost    : $CHAR060.
            spm1     : $CHAR005.
            spm2     : $CHAR005.
            spm3_1   :  NUMX009.
            spm3_2_  : $CHAR005.
            spm4_1   :  NUMX009.
            spm4_2   :  NUMX009.
            spm4_3   :  NUMX009.
            spm4_4   :  NUMX009.
            spm4_5   :  NUMX009.
            spm4_6   :  NUMX009.
            spm4_7   : $CHAR001.
            spm5     :  NUMX009.
            spm6     : $CHAR060.
            spm7_1   : $CHAR090.
            spm7_2   : $CHAR080.
            spm8     :  NUMX005.
            spm9     :  NUMX005.
            merknad  : $CHAR200.
      ;
      stoffgr = COMPRESS(PUT(stoffgr_,z2.),'.');
      LENGTH org_nr $ 10;
      org nr = "&org nr.";
      IF spm3_2_ = 'SANN' THEN spm3_2 = 1;
       ELSE
       DO;
```

```
        SELECT (stoffgr);
         WHEN ('01')            spm3_2 = 0.92;
         WHEN ('02','03','14')  spm3_2 = 0.99;
         WHEN ('04')            spm3_2 = 0.9;
         OTHERWISE              spm3_2 = 1;
        END;
       END;

DATA forbehandling_&org_nr.;
SET behandling_&org_nr. (KEEP=spm7_1 spm7_2);
 WHERE spm7_1 NE '';
%MEND;

DATA _NULL_;
SET spesavf.flettefil;
   CALL EXECUTE ('%flett('||org_nr||')');
RUN;
RUN;
RUN;

PROC SQL NOPRINT;
 SELECT 'behandling_'||org_nr AS org_nr
 INTO :org_nr SEPARATED BY " "
 FROM spesavf.flettefil
;

DATA inkosys_&telleaar. (DROP=bnr_ nace stoffgr_ stoffnr eak_kode stoffnavn
enhet);
      INFILE "X:\220\AVFALL\3
Spesialavfall\Data\behandling\inkosys_&telleaar..txt" MISSOVER DSD PAD
DELIMITER='09'X FIRSTOBS=2;
      INPUT bnr_       :      008.
              navn_f    : $CHAR040.
              nace      : $CHAR006.
              stoffgr_  :      008.
              stoffnr   : $CHAR004.
              eak_kode  : $CHAR006.
              stoffnavn : $CHAR100.
              enhet     : $CHAR004.
              spm3_1    :  NUMX009.
              spm4_2    :  NUMX009.
              spm4_4    :  NUMX009.
              spm4_6    :  NUMX009.
      ;
      stoffgr = COMPRESS(PUT(stoffgr_,z2.),'.');
      aar = "&telleaar.";
      IF enhet = 'tonn' THEN spm3_2 = 1;
       ELSE spm3_2 = .;
      spm1 = 'USANN';
      spm2 = 'USANN';
      spm4_1 = 0;
      spm4_3 = 0;
      spm4_5 = 0;
      spm4_7 = '';
      spm5 = 0;
      spm6 = '';
      spm7_1 = '';
      spm7_2 = '';
      spm8 = 100;
      spm9 = 0;
      bnr = COMPRESS(PUT(bnr_,z8.),'.');
```

```
RUN;

DATA vanlig_anlegg_&telleaar. (DROP=stoffgr_ bnr_
WHERE=(aar="&telleaar."));
      INFILE "X:\220\AVFALL\3 Spesialavfall\Data\behandling\Deponering.txt"
MISSOVER DSD PAD DELIMITER='09'X FIRSTOBS=2;
      INPUT aar      : $CHAR04.
            stoffgr_ :      08.
            spm4_4   :  NUMX09.
      ;
      bnr_ + 1;
      bnr = COMPRESS(PUT(bnr_,z8.),'.');
      stoffgr = COMPRESS(PUT(stoffgr_,z2.),'.');
      spm3_1 = spm4_4;

      spm1 = 'USANN';
      spm2 = 'USANN';
      spm3_2 = 1;
      spm4_1 = 0;
      spm4_2 = 0;
      spm4_3 = 0;
      spm4_5 = 0;
      spm4_6 = 0;
      spm4_7 = '';
      spm5 = 0;
      spm6 = '';
      spm7_1 = '';
      spm7_2 = '';
      spm8 = 100;
      spm9 = 0;
RUN;

DATA eksport&telleaar. (DROP=deklarert stoffnr basel oecd endrdato init
endrtype eak_kode rang behandlet);
SET spesavf.eksport&telleaar. (RENAME=(bnr_link=bnr navn=navn_f));
 aar = "&telleaar.";
 stoffgr = SUBSTR(stoffnr,2,2);
 spm3_1 = mengde;
 eksport = mengde;

      spm1 = 'USANN';
      spm2 = 'USANN';
      spm3_2 = 1;
      spm4_1 = 0;
      spm4_2 = 0;
      spm4_3 = 0;
      spm4_4 = 0;
      spm4_5 = 0;
      spm5 = 0;
      spm4_6 = 0;
      spm4_7 = '';
      spm6 = '';
      spm7_1 = '';
      spm7_2 = '';
      spm8 = 100;
      spm9 = 0;
RUN;


DATA spesavf.behandling&telleaar. (DROP=aar poststed person tlf fax epost
merknad spm3_2_);
```

```
SET &org_nr. inkosys_&telleaar. vanlig_anlegg_&telleaar. eksport&telleaar.;
 IF aar = "&telleaar." THEN OUTPUT;
RUN;

DATA spillolje_forbrent_&telleaar. (DROP=bnr_ stoffgr_ WHERE=(forbrent GT
0));
      INFILE "X:\220\AVFALL\3
Spesialavfall\Data\behandling\spillolje_forbrent_&telleaar..txt" MISSOVER
DSD PAD DELIMITER='09'X FIRSTOBS=2;
      INPUT bnr_      :      08.
              navn      : $CHAR40.
              stoffgr_  :      08.
              forbrent  :  NUMX09.
      ;
      bnr = COMPRESS(PUT(bnr_,z8.),'.');
      stoffgr = COMPRESS(PUT(stoffgr_,z2.),'.');
      mottatt = forbrent;
      en_utnytt = 100;
RUN;

PROC SQL;
 CREATE TABLE behandling&telleaar._midl1 AS
 SELECT COALESCE(a.bnr,c.bnr,b.bnr) AS bnr,
            COALESCE(a.navn_b,a.navn_f,c.navn) AS navn,
            COALESCE(c.stoffgr,a.stoffgr) AS stoffgr,
            COALESCE(c.mottatt,a.spm3_1*a.spm3_2,0) AS mottatt,
            COALESCE(a.spm4_1*a.spm3_2,0) AS matr_gjv,
            COALESCE(c.forbrent,a.spm4_2*a.spm3_2,0) AS forbrent,
            COALESCE(a.spm4_3*a.spm3_2,0) AS biologisk,
            COALESCE(a.spm4_4*a.spm3_2,0) AS deponert,
            COALESCE(a.spm4_5*a.spm3_2,0) AS uskadelig,
            COALESCE(a.spm4_6*a.spm3_2,0) AS annen,
            (COALESCE(c.mottatt,a.spm3_1*a.spm3_2,0)-
COALESCE(a.spm4_1*a.spm3_2,0)-COALESCE(c.forbrent,a.spm4_2*a.spm3_2,0)-
                  COALESCE(a.spm4_3*a.spm3_2,0)-
COALESCE(a.spm4_4*a.spm3_2,0)-COALESCE(a.spm4_5*a.spm3_2,0)-
                  COALESCE(a.spm4_6*a.spm3_2,0)-
COALESCE(a.spm5*a.spm3_2,0)-COALESCE(a.eksport*a.spm3_2,0)) AS forbeh,
            a.spm4_7 AS forbeh_JQ,
            COALESCE(a.eksport,0) AS eksport,
            COALESCE(a.spm5*a.spm3 2) AS videre,
            COALESCE(a.spm8,c.en_utnytt,0) AS en_utnytt,
            COALESCE(a.spm9,0) AS tidsbruk,
            COALESCE(c.forbrent,0)+COALESCE(a.spm3_1*a.spm3_2,0)-
COALESCE(c.forbrent,a.spm3_1*a.spm3_2,0) AS test
 FROM spesavf.behandling&telleaar. AS a
 LEFT OUTER JOIN spesavf.flettefil AS b
 ON a.org_nr = b.org_nr
 FULL OUTER JOIN spillolje_forbrent_&telleaar. AS c
 ON b.bnr = c.bnr AND a.stoffgr = c.stoffgr AND c.bnr NE ''
;

PROC SQL;
 CREATE TABLE spesavf.behandling&telleaar._tabell_spesavfgr AS
 SELECT stoffgr, ROUND(SUM(mottatt)) AS mottatt,
ROUND(SUM(forbrent*en_utnytt/100)) AS forbrent_en,
            ROUND(SUM(forbrent*(100-en_utnytt)/100)) AS forbrent_sb,
ROUND(SUM(matr_gjv)) AS matr_gjv,
            ROUND(SUM(biologisk)) AS biologisk, ROUND(SUM(deponert)) AS
deponert, ROUND(SUM(uskadelig)) AS uskadelig,
```

```
            ROUND(SUM(annen)) AS annen, ROUND(SUM(forbeh)) AS forbeh,
ROUND(SUM(eksport)) AS eksport,
            ROUND(SUM(videre)) AS videre, ROUND(SUM(tidsbruk)/60,.1) AS
tidsbruk
 FROM behandling&telleaar._midl1
 GROUP BY stoffgr
;

PROC SQL;
 CREATE TABLE spesavf.behandling&telleaar._tabell_ewcstat AS
 SELECT b.ewc_stat, ROUND(SUM(a.mottatt*b.faktor)) AS mottatt,
ROUND(SUM(a.forbrent_en*b.faktor)) AS forbrent_en,
            ROUND(SUM(a.forbrent_sb*b.faktor)) AS forbrent_sb,
ROUND(SUM(a.matr_gjv*b.faktor)) AS matr_gjv,
            ROUND(SUM(a.biologisk*b.faktor)) AS biologisk,
ROUND(SUM(a.deponert*b.faktor)) AS deponert,
            ROUND(SUM(a.uskadelig*b.faktor)) AS uskadelig,
ROUND(SUM(a.annen*b.faktor)) AS annen,
            ROUND(SUM(a.forbeh*b.faktor)) AS forbeh,
ROUND(SUM(a.eksport*b.faktor)) AS eksport,
            ROUND(SUM(a.videre*b.faktor)) AS videre, MEAN(a.tidsbruk) AS
tidsbruk
 FROM spesavf.behandling&telleaar._tabell_spesavfgr AS a
 JOIN spesavf.oversett_spesavfgr_til_ewcstat AS b
 ON a.stoffgr = b.spesavfgr
 GROUP BY b.ewc_stat
;

PROC EXPORT DATA= Spesavf.Behandling&telleaar._tabell_spesavfgr
            OUTFILE= "X:\220\AVFALL\3
Spesialavfall\Data\Behandling\behandling_ssb_&telleaar..txt"
            DBMS=TAB REPLACE;
RUN;

PROC EXPORT DATA= Spesavf.Behandling&telleaar._tabell_ewcstat
            OUTFILE= "X:\220\AVFALL\3
Spesialavfall\Data\Behandling\behandling_EUROSTAT_&telleaar..txt"
            DBMS=TAB REPLACE;
RUN;

PROC SQL;
 CREATE TABLE grunnlagsdatabasen&telleaar. stoffgr AS
 SELECT SUBSTR(stoffnr,2,2) AS stoffgr, SUM(mengde) AS mengde
 FROM spesavf.grunnlagsdatabasen&telleaar.
 GROUP BY stoffgr
;

PROC SQL;
 CREATE TABLE spesavf.behandling&telleaar._tabell2_spesavfgr AS
 SELECT COALESCE(a.stoffgr,b.stoffgr) AS stoffgr, SUM(a.mottatt-a.videre)
AS behandlet, ROUND(SUM(b.mengde)) AS innsamlet
 FROM spesavf.behandling&telleaar._tabell_spesavfgr AS a
 JOIN grunnlagsdatabasen&telleaar._stoffgr AS b
 ON a.stoffgr = b.stoffgr
 GROUP BY a.stoffgr, b.stoffgr
;

PROC EXPORT DATA= Spesavf.Behandling&telleaar._tabell2_spesavfgr
            OUTFILE= "X:\220\AVFALL\3
Spesialavfall\Data\Behandling\behandling_ssb2_&telleaar..txt"
            DBMS=TAB REPLACE;
```

```
RUN;

*Intermediate processing in Excel prior to this step!;
DATA behandling_ssb_2003_RD (DROP=stoffgr_);
      INFILE "X:\220\AVFALL\3
Spesialavfall\Data\behandling\behandling_ssb_2003_RD.txt" MISSOVER DSD PAD
DELIMITER='09'X FIRSTOBS=2;
      INPUT stoffgr_        :      08.
              Collect         :      08.
              R1              :      08.
              R2_R9           :      08.
              R2              :      08.
              R3_R5           :      08.
              R4              :      08.
              R6              :      08.
              R9              :      08.
              D1              :      08.
              D10             :      08.
              Chem_R10_D1     :      08.
              Chem_D12        :      08.
              Biol_D1_water   :      08.
              Other           :      08.
              Pre_treat       :      08.
              Export          :      08.
              Double_count    :      08.
              Collect_adj_dc  :      08.
              Resp_burden     :   NUMX08.1
      ;
      stoffgr = COMPRESS(PUT(stoffgr_,z2.),'.');
RUN;

PROC SQL;
 CREATE TABLE behandling_EUROSTAT_&telleaar._RD AS
 SELECT b.ewc_stat, ROUND(SUM(a.Collect*b.faktor)) AS Collect,
ROUND(SUM(a.R1*b.faktor)) AS R1, ROUND(SUM(a.R2_R9*b.faktor)) AS R2_R9,
            ROUND(SUM(a.R2*b.faktor)) AS R2, ROUND(SUM(a.R3_R5*b.faktor))
AS R3_R5, ROUND(SUM(a.R4*b.faktor)) AS R4, ROUND(SUM(a.R6*b.faktor)) AS R6,
            ROUND(SUM(a.R9*b.faktor)) AS R9, ROUND(SUM(a.D1*b.faktor)) AS
D1, ROUND(SUM(a.D10*b.faktor)) AS D10,
            ROUND(SUM(a.Chem_R10_D1*b.faktor)) AS Chem_R10_D1,
ROUND(SUM(a.Chem_D12*b.faktor)) AS Chem_D12,
            ROUND(SUM(a.Biol_D1_water*b.faktor)) AS Biol_D1_water,
ROUND(SUM(a.Other*b.faktor)) AS Other,
            ROUND(SUM(a.Pre_treat*b.faktor)) AS Pre_treat,
ROUND(SUM(a.Export*b.faktor)) AS Export,
            ROUND(SUM(a.Double_count*b.faktor)) AS Double_count,
ROUND(SUM(a.Collect_adj_dc*b.faktor)) AS Collect_adj_dc,
            MEAN(a.Resp_burden) AS Resp_burden
 FROM behandling_ssb_2003_RD AS a
 JOIN spesavf.oversett_spesavfgr_til_ewcstat AS b
 ON a.stoffgr = b.spesavfgr
 GROUP BY b.ewc_stat
;

PROC EXPORT DATA= behandling_EUROSTAT_&telleaar._RD
            OUTFILE= "X:\220\AVFALL\3
Spesialavfall\Data\Behandling\behandling_EUROSTAT_&telleaar._RD.txt"
            DBMS=TAB REPLACE;
RUN;

PROC SQL NOPRINT;
```

```
 SELECT 'forbehandling_'||org_nr AS org_nr
 INTO :orgnr_f SEPARATED BY " "
 FROM spesavf.flettefil
;

DATA midler1.forbehandling;
SET &orgnr_f.;
RUN;

PROC EXPORT DATA= Midler1.Forbehandling
            OUTFILE= "X:\220\AVFALL\3
Spesialavfall\Data\Behandling\forbehandling_inn.txt"
            DBMS=TAB REPLACE;
RUN;

DATA forbehandling_bearb1 (DROP=stoffgr_midl_01-stoffgr_midl_10);
      INFILE "X:\220\AVFALL\3
Spesialavfall\Data\Behandling\forbehandling_ut.txt" MISSOVER DSD PAD
DELIMITER='09'X FIRSTOBS=2;
      INPUT forbeh_type : $CHAR100.
              (stoffgr_midl_01-stoffgr_midl_10) (10*: 8.)
      ;
      stoffgr01 = COMPRESS(PUT(stoffgr_midl_01,z2.),'.');
      stoffgr02 = COMPRESS(PUT(stoffgr_midl_02,z2.),'.');
      stoffgr03 = COMPRESS(PUT(stoffgr_midl_03,z2.),'.');
      stoffgr04 = COMPRESS(PUT(stoffgr_midl_04,z2.),'.');
      stoffgr05 = COMPRESS(PUT(stoffgr_midl_05,z2.),'.');
      stoffgr06 = COMPRESS(PUT(stoffgr_midl_06,z2.),'.');
      stoffgr07 = COMPRESS(PUT(stoffgr_midl_07,z2.),'.');
      stoffgr08 = COMPRESS(PUT(stoffgr_midl_08,z2.),'.');
      stoffgr09 = COMPRESS(PUT(stoffgr_midl_09,z2.),'.');
      stoffgr10 = COMPRESS(PUT(stoffgr_midl_10,z2.),'.');
RUN;

PROC SORT DATA=forbehandling_bearb1 OUT=forbehandling_bearb2 NODUPKEY;
 BY forbeh_type stoffgr01-stoffgr10;
RUN;

PROC TRANSPOSE DATA=forbehandling_bearb2
                    OUT=forbehandling_bearb3 (DROP=_NAME_
RENAME=(col1=stoffgr01 col2=stoffgr02) WHERE=(stoffgr01 NE ''));
 BY forbeh_type;
 VAR stoffgr01-stoffgr10;
RUN;

DATA forbehandling_bearb4 (DROP=stoffgr02 RENAME=(stoffgr01=stoffgr)
WHERE=(stoffgr NE ''));
SET forbehandling_bearb3;
RUN;

DATA forbehandling_bearb5 (DROP=stoffgr01 RENAME=(stoffgr02=stoffgr)
WHERE=(stoffgr NE ''));
SET forbehandling_bearb3;
RUN;

DATA forbehandling_bearb6;
SET forbehandling_bearb4 forbehandling_bearb5;
RUN;

PROC SORT DATA=forbehandling_bearb6 OUT=forbehandling_bearb7 NODUPKEY;
 BY forbeh_type stoffgr;
```

```
RUN;

PROC EXPORT DATA= forbehandling_bearb7
            OUTFILE= "X:\220\AVFALL\3
Spesialavfall\Data\Behandling\forbehandling_EUROSTAT.txt"
            DBMS=TAB REPLACE;
RUN;
```

Appendix 3 : Questionnaire used in the survey.

Comments:

Explanations:

Hazardous waste group: Classification codes on hazardous waste by material, which was introduced by the Hazardous Waste Regulation from 1984. The code can be found by eliminating the first and last digit of the hazardous waste number, and if necessary eliminate any preliminary zeros. For example, waste number 7152 belongs to hazardous waste group 15, while waste number belongs group number 1.

Category	Name	Explanation
1	Waste oil	Spent motor oil, gear oil, hydraulic oil, transformer oil etc. No differentiation has been made between waste with repayment and waste without repayment.
2	Other oil containing waste	Oily waste from plants treating oil-containing wastewater, oily waste from tank cleaning, contaminated fuels and fuel oils, oil filters.
3	Stable oil emulsions	Emulsions based on mineral oil and water. Stop water.
4	Solvents, organic	Organic solvents with or without halogens.
5	Paint, adhesives, varnish, etc.	Paint, adhesives, varnish and inks.
8	Mercury and cadmium	Waste and materials containing mercury or cadmium, for example mercury containing batteries or NiCd batteries.
9	Other waste containing heavy metals	Prioritised health and environmentally harmful metals or metal compounds not included in group 8. Includes metals or compounds classified as very toxic, toxic or environmentally harmful. Lead accumulators.
10	Cyanides	Solid or liquid waste containing cyanides (electrolysis baths, hardener salts, etc.).
11	Pesticides etc.	Pesticides and other biocides.
12	Iso-cyanates etc.	Iso-cyanates and other strongly reactive compounds. For example toluenediisocyanate (TDI) and methanediphenyl-diisocyanate (MDI).
13	Corrosive waste	Acids, bases and other corrosive wastes.
14	Oil drilling waste	Drilling fluids and stones and gravel from oil drilling, together with other fluids from oil drilling/production containing oil or chemicals.
15	Other very toxic, toxic, or environmentally harmful waste	Waste containing organic compounds classified as very toxic, toxic or environmentally harmful according to regulations on health and environmental labelling, and not falling into any of the other hazardous waste categories.
16	Processing water	Contaminated wastewater and water-based solutions not allowed entering municipal wastewater.
21	PCBs	Polychlorinated biphenyls. Includes PCTs, dioxins and furans, and liquid mixtures or objects contaminated by these compounds.
22	Photo chemicals	Includes developer and fixer baths, plus film- and paper materials containing silver, in accordance to separate regulation.
23	Halones	Includes completely halogenated halones only, like Halone 1211, Halone 1301 and Halone 2402, plus their associated isomers. Instruments and equipments containing halones are not considered hazardous waste.
24	Chlorofluorocarbons	Pure compounds and mixtures of completely halogenated chlorofluorocarbons and their associated isomers. Instruments and equipments containing chlorofluorocarbons are not considered hazardous waste.
25	Asbestos	Isolation materials containing asbestos, heated water pipelines and boilers. Filter media. Heat isolated equipment like gloves, aprons and clothes.
99	Other hazardous waste	Hazardous waste that does not belong to any of the other categories, however still fall in under the Regulation on Hazardous Waste. Please describe the waste under "remarks", see top, this page. (Carefully assess if the waste in question may belong to category 15 before using category 99).

Previously codes 6 and 7 now belong in under code 15.

Treatment: A collective term for pre-treatment and final disposal.

Pre-treatment: Process where the weight of waste or hazardous waste category is changed, and where final product is still considered hazardous waste, for example mixtures of different hazardous waste categories, production of fuel mixtures, neutralisation, precipitation, filtering and biological processes, where final product is still being a hazardous waste. Exemptions to pre-treatment are: decanting of water from oil mixtures and re-packing (meaning transfer of hazardous waste of the same category into new packing).

Final treatment: Treatment/disposal operations like recycling, incineration, landfill etc., or physical/chemical/biological process where final product is not considered hazardous waste any more (for example neutralisation or precipitation).

Rendering non-hazardous: Physical/chemical/biological process where the final product is not considered hazardous waste.

Statistisk sentralbyrå
Statistics Norway

Division for
Environmental Statistics
2225 Kongsvinger

Deadline:
15th of March 2004

Bound by profesional secrecy.
Obligatory reporting.

Treatment of hazardous waste 2003

Name of enterprise «NAVN»	*Enterprise id* «org_nr»	
Name of the business (please fill in when the business answers on the behalf of the enterprise)	*Contact person* «Kontaktperson»	
Enterprise address «UT_ADR1»	*Phone number* «Tlf»	*Fax number* «Telefaks»
Postal code «ut_pnr» / *Place* «ut_psted»	*E-mail* «Epost»	

Please underline erroneous information and replace with correct information. Fill in missing information..

What types of waste are to be included?
This form encompass hazardous waste as defined by Regulation on hazardous wastes 1st of January 2003. **Only** include hazardous waste that has been *received from other businesses or private persons*. Do **not** include hazardous waste originating within the business in question. For further guidance, please refer to instruction manual.

How to fill in the form?
Either: Download excel-version of the form from http://www.ssb.no/emner/01/05/30/. Choose "Activate macro". Excel 2000 or more recent version is needed. *Or:* Make use of the paper version. Statistics Norway recommends the Excel-version.

The enterprise can either fill in the form on behalf of all associated businesses, or send a copy to those businesses in relevance for the survey. In either way, the enterprise is responsible for the information flow back to Statistics Norway.

Statistics Norway has pre-filled enterprise related information in the *upper part of this page*. Please correct if any of this information if erroneous or missing. Businesses who fill in the form on behalf of their enterprise is asked to also fill in name of the business on the next upper line to the left.

Question 1 to 9, next page: Question 1 and 2 is a filter question. In question 3 to 5, we're asking for amount of hazardous waste being received, final disposal and waste being forwarded. List up the amounts in accordance with their hazardous waste category. If the waste change hazardous waste category as a consequence of pre-treatment within the enterprise, then the waste shall be listed under their new category under question 4 and 5. The overall intention is that all the information needed to answer questions 3 to 6 is to be found in business logs, receipts etc.

Enterprises which are not bound by government licences on logging of hazardous waste being received and forwarded, and which cannot answer questions 3 to 6 without further "research" (included contact with other enterprises), will be asked to make a remark on that on the last page, under "remarks". In instances like that, enterprises are encouraged to estimate the information being asked for.

The instruction manual provides important information on every single question, so please refer to the manual for each question for further details.

Please write possible *remarks* to the form itself or specific questions under the "remarks", on the last page.

Explanations and *definitions* of words being underlined throughout this form are provided on the last page.

For further information:
Please contact Executive Officer:

Håkon Skullerud.
Telephone: 62 88 51 51
E-mail: haakon.skullerud@ssb.no

RA 0530

Recent publications in the series Documents

2003/7 B.A. Holth, T. Risberg, E. Wedde og H. Degerdal: Continuing Vocational Training Survey (CVTS2). Quality Report for Norway.

2003/8 P.M. Bergh and A.S. Abrahamsen: Energy consumption in the services sector. 2000

2003/9 K-G. Lindquist and T. Skjerpen: Exploring the Change in Skill Structure of Labour Demand in Norwegian Manufacturing

2004/1 S. Longva: Indicators for Democratic Debate - Informing the Public at General Elections.

2004/2 H. Skiri: Selected documents on the modernisation of the civil registration system in Albania.

2004/3 J.H. Wang: Non-response in the Norwegian Business Tendency Survey.

2004/4 E. Gulløy and B.K Wold: Statistics for Development, Policy and Democracy. Successful Experience and Lessons Learned through 10 years of statistical and institutional development assistance and cooperation by Statistics Norway

2004/5 S. Glomsrød and L. Lindholt: The petroleum business environment.

2004/6 H.V. Sæbø: Statistical Metadata on the Internet Revised.

2004/7 M.Bråthen: Collecting data on wages for the Labour - pilot

2004/8 A.L. Brathaug and E. Fløttum: Norwegian Experiences on Treatment of Changes in Methodologies and Classifications when Compiling Long Time Series of National Accounts.

2004/9 L. Røgeberg, T. Skoglund and S. Todsen: Report on the Project Quality Adjusted Input Price Indicies for Collective Services in the Norwegian National Accounts. Report from a Project Co-financed by Eurostat.

2004/10 A-K. Mevik: Uncertainty in the Norwegian Business Tendency Survey.

2004/11 A.G. Hustoft, J. Linnerud and H.V. Sæbø: Quality and metadata in Statistics Norway.

2004/12 E. Engelien, R. Klæboe and Margrete Steinnes: Neighbourhood sonoscapes. Context sensitive noise impact mapping .

2004/13 Petter Vegard Hansen: Regional electricity spot price responses in Norway.

2004/14 A.G. Hustoft and J. Linnerud: Development of a variables documentation system in Statistics Norway. International Statistical Conference "Investment in the future", Prague, Czech Republic, 6-7 September 2004.

2004/15 J.L. Hass: Compilation of data on expenditure in Environmental protection by businesses. Report to the European Commission DG for Environment.

2004/16 A. Raknerud, J. Rønningen og T. Skjerpen: Documentation of the capital database. A database with data for tagible fixed assets and economic data at the firm level.

2004/17 B.K. Wold D. Roll-Hansen A. Mathiassen and S. Opdahl: A Sustainable Household Survey Based Poverty Monitoring System. A Poverty Monitoring System Based upon Household Survey Estimation of Total Consumption. A Preliminary Paper Asking for Cooperation

2004/18 T. Karlsen, D. Quang Pham and T. Skjerpen: Seasonal adjustment and smoothing of manufacturing investments series from the quartely Norwegian national accounts

2005/1 V. Skirbekk: The Impact of a Lower School Leaving Age and a Later Retirement on the Financing of the Norwegian Public Pension System.

2005/2 H. Utne: The Population and Housing Censushandbook 2001.

2005/3 J. L.Hass and R. Straumann: Environmental Protection Expenditure: Methodological work for the Oil and Gas Extraction Industry. Report to Eurostat.

2005/4 L. Hobbelstad Simpson: National Accounts Supply and Use Tables (SUT) in Constant Prices SNA-NT "SUT/CONSTANT"

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.

2005/7 E. Ugreninov, T.M. Normann and A. Andersen: Intermediate Quality Report EU-SILC 2003 Statistics Norway.

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.