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Statistics on waste and recycling

Survey conducted in 1994 within the major divisions of industry; oil extraction, quarrying and mining, manufacturing industry and construction industry

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Enclosure: Questionnaires

Summary

Based on Report No. 44 (1992 Ministry of Environment) to the Storting (the Norwegian National Assembly) and useful experience obtained from a pilot survey in 1993, it was decided to conduct a sample survey in three industrial branches. Data was to be collected by interview in cooperation with the municipalities. It is worthy to note that the establishments were not compelled to receive the interviewers. Establishments that did not wish to receive an interviewer were however, obliged to reply by mail. A questionnaire was sent from SN to the establishments at least 14 days before the interview.

The data were collected by authority of Act No. 54 of 16 June 1989 relating to official statistics and Statistics Norway.

The sample survey was based on 1646 establishments drawn from 60 municipalities within industry divisions ISIC 2; *Oil extraction, mining and quarrying*, ISIC 3; *Manufacturing* and ISIC 5; *Construction*.

Due to lack of up-dated registers, the sample was reduced to 1545 establishments. The response rate was 98 per cent.

The main conclusions from the survey can be listed as follows:

- ** The questionnaire functioned satisfactorily.
- ** In general, the municipal employees did a good job as interviewers.
- ** The establishments have satisfactory knowledge of the waste that they generate. On the other hand, knowledge of how it is treated is generally lacking.
- ** Answers were received on questions about quantities of hazardous waste. Consequently, hazardous waste should be included in future surveys on waste.
- ** Some of the figures are highly uncertain. This is mainly due to the small sample size.
- ** A positive correlation was found between quantity of waste and size of establishment. In spite of this, the results from this survey do not provide a sufficient basis for calculating unambiguous coefficients for the relation between quantity of waste and number of employees. For this, the standard deviations were too large.

STATISTICS ON WASTE FROM INDUSTRY

A survey conducted in 1994 among a sample of establishments in the major divisions of industry; oil extraction, quarrying and mining, manufacturing industry and construction industry.

1. INTRODUCTION

1.1. Background and purpose

In 1991, the Norwegian Pollution Control Authority (Statens Forurensningstilsyn - SFT) presented a proposal for future statistics on waste (SFT 1991). In Report No. 44 (1991-92) to the Storting (the Norwegian National Assembly) on minimization, recycling and responsible management of waste, it is specifically stated that "*the existing statistics and information on waste and recycling are deficient and unreliable, and prevent effective evaluation of the measures and instruments employed within the field of waste management*". Statistics Norway (SN) was given the main responsibility for the further efforts to develop national statistics on waste.

The purpose of this work was to prepare statistics which will:

- ** Satisfy the Ministry of Environment's and SFT's need for data reporting in connection with the evaluation of the results of the different measures (outcome assessment)
- ** Satisfy the requirement for data as a basis for central and local planning and management.
- ** Provide a basis for studying alternative forms of treatment, preparing a programme for waste minimization and recycling, and considering general environmental issues.
- ** Meet international requirements regarding classification of data and methodology for data collection.
- ** Provide information to industry, educational institutions, interest organizations, the media and individual persons.

The first step in this work was to undertake a survey of municipal waste. A pilot survey was carried out in 1992 in 22 municipalities (SN 1992), followed by a survey of all municipalities in 1993 (SN 1993a) and a new survey among a sample of 49 municipalities in 1994 and 1995. The work of preparing statistics on the generation of industrial waste proceeded simultaneously as the comprehensive survey on municipal waste. A pilot study was conducted in spring 1993 among a sample of establishments from a selection of industries and municipalities (SN 1993b). This was followed in spring 1994 by the survey described in this report, conducted in a sample of 60 municipalities.

1.2. Experience from the pilot survey in 1993

The pilot survey in 1993 provided the basis for the survey in 1994. One of the most crucial problems that had to be solved in the pilot survey had to do with the method of data collection. We were aware from earlier experience that collecting data by means of mailed questionnaires does not require extensive resources, but involves a high risk of both incomplete answers and high drop-out. After visiting establishments and reviewing surveys carried out at regional level by municipalities, county governors and consultants, expectations with regard to the reliability of mailed questionnaires were low. In Sweden, intermunicipal surveys of industry by means of interviews have been experimented. This method was an unqualified success (Västmanlands avfallsaktiebolag 1992). Some Norwegian municipalities have carried out a similar experiment, and came out with successful results.

It was therefore decided to test out both methods in the pilot survey:

- ** About 1/3 of the establishments were to be visited and representatives interviewed during weeks 21-23.
- ** The rest were to answer a questionnaire, which was to be returned by 1st July.

SN itself does not have the resources to carry out such interviews, which require a high level of expertise, on a large scale. However, it is stated in Report No. 44 to the Storting (Ministry of Environment 1992) that, in the future, the municipalities will have greater responsibility for management of industrial waste. In order to meet this requirement, the municipalities will be compelled to obtain an overview of the industrial waste generated within their own boundaries. It was proposed that SN and the municipalities should cooperate on the survey, and that some of the interviews should be undertaken by SN and some by a municipal employee (preferably the environmental officer or an official from the technical services). A questionnaire was to be distributed at least 14 days before the visit.

The conclusions from the pilot study can be summarized as follows:

- ** The interview method was much better than the mailing method and is to be preferred for a comprehensive survey.
- ** Municipal employees can be used as interviewers.
- ** The establishments are willing to provide information on their waste, including information on hazardous waste.
- ** In general, the questionnaire functioned satisfactorily.
- ** Considering that participation was voluntary, the percentage response was relatively good.
In a comprehensive survey, participation should not be voluntary. The information should be obtained by authority of the Statistics Act.
- ** Small establishments generate little waste, and can be omitted from a comprehensive survey.

- ** The Establishments Register can be used even if it is not completely up-to-date. If it is used, however, it should be stratified by type of establishment (main establishment/single establishment/other establishment/auxiliary department).

Our survey in 1994 was conducted on the basis of these conclusions.

2. DEFINITIONS

Waste is defined in accordance with § 27 of the Pollution Control Act:

"Waste means discarded objects or substances. Waste also includes superfluous objects from service activities, production and treatment plants etc. Waste water and exhaust gases are not regarded as waste.

Consumer waste means ordinary waste, including larger objects such as furnishings etc. from households, small shops etc. and offices. The same applies to waste of a similar type and quantity from other activities.

Production waste means waste from industrial activities and service activities which in type and quantity is significantly different from consumer waste.

Hazardous waste means waste which cannot be appropriately treated together with consumer waste because it may lead to serious pollution or risk of injury to persons or animals."

We chose to use source as the primary factor for classifying the waste. *The source* is the individual establishment within selected divisions of industry. *An establishment* is defined in accordance with SN's Establishments Register as *a functional unit which at a single physical location is engaged predominantly in activities within a specific activity group*. The term *group* means a collection of economic activities that are as homogenous as possible as regards technical organization of the production of goods and services and as regards the nature and application of the goods and services. *Group* is the fourth level of classification used in the Standard for Industrial Classification, which is based on the UN international standard ISIC - International Standard Industrial Classification of all Economic Activities). There are five levels of classification in all:

Major division	1-digit code
Division	2-digit code
Major group	3-digit code
Group	4-digit code
Sub-group	5-digit code (National Norwegian level)

The term *manufacturing* refers to activities within the following major divisions of industrial activities:

ISIC code

3	Manufacturing
3 1	Manufacture of food, beverages and tobacco
3 2	Manufacture of textiles, wearing apparel, leather and leather products
3 3	Manufacture of wood and wood products, including furniture
3 4	Manufacture of paper and paper products, printing and publishing
3 5	Manufacture of chemicals and of chemical petroleum, coal, rubber and plastic products
3 6	Manufacture of mineral products
3 7	Manufacture of basic metals
3 8	Manufacture of fabricated metal products, machinery and equipment
3 9	Other manufacturing industries

In this survey, *oil extraction, mining and quarrying*, means activities within the following division of industry:

ISIC code

2	Oil extraction, mining and quarrying
2 2	Extraction of crude oil and natural gas
2 3	Metal ore mining
2 9	Other mining

In this survey, *construction* means activities under ISIC 50: Construction.

Manufacturing waste includes all waste from activities within the divisions ISIC 31-39. This implies, therefore, that production waste, consumer waste (e.g. waste from canteens and offices, packaging) and hazardous waste are all classified as waste from manufacturing.

Similarly, waste from *oil extraction, mining and quarrying* and waste from *construction* means all waste (production waste, consumer waste and hazardous waste) from ISIC divisions 22, 23 29 and 50 respectively.

For a more detailed description of waste a classification based on component materials has been used, which takes into account the materials' potential for recycling and re-use (see page 5). Material that is used again or recycled on the establishment's own premises is not included in the quantities of waste.

3. CONVERSION FACTORS

The experience obtained from the surveys on municipal waste, from visits to establishments and from the pilot survey brought to light the need to use specific factors to convert the figures from volume to weights. In some cases the factors were those used in SN's statistics on municipal waste, and in other cases they were the factors used by Statistics Finland (marked with a * in the list below). The Norwegian factors are based on calculations of container loads, carried out by Søndre Vestfold Avfallsselskap (a regional Norwegian waste treatment plant). The total net weight of a specific load was divided by

the total volume of the containers. The degree to which the containers were filled was disregarded.

The factors that were used: m³ x factor:

		<u>Factor</u>
1. Mixed waste	loose in container	0.16
2. Paper/cardboard	loose in container	0.1
	compressed	0.4
3. Plastic		0.4
4. Glass		0.4
5. Husks etc. from grain		0.15 (*)
6. Sawdust		0.3
7. Chipboard		0.5 (*)
8. Tyres		0.136
9. Glass wool and mineral wool		0.1 (*)
10. Ash, slag		1.0 (*)
11. Concrete, gravel, stone		2.0 (*)
12. Oil		0.9 (*)
13. Iron clippings		0.45
14. Food waste		1.0 (*)
15. Paint, glue, varnish		1.2 (*)

4. DATA COLLECTION METHODS

Based on the useful experience obtained from the pilot survey, it was decided to collect the data by interview in cooperation with the municipalities. However, the establishments were not compelled to receive the interviewers. Establishments that did not wish to receive an interviewer, were, however, obliged to reply by mail. The questionnaire was sent from SN to the establishments at least 14 days before the interview.

The data were collected by authority of Act No. 54 of 16 June 1989 relating to official statistics and Statistics Norway.

5. THE CONTENT OF THE QUESTIONNAIRE

To all intents and purposes, the content of the questionnaire was the same as in the pilot survey, but adjusted slightly in the light of the experience gained at that time. The content is based on studies of questionnaires used in the Netherlands and Finland, on the guidelines prepared by the Confederation of Norwegian Business and Industry (NHO) for the introduction of cleaner production, the EU's proposals for a catalogue of wastes, UN/ECE's classification of waste, SFT's long-term plan and interviews with establishments responsible for the management of waste.

As in the case of the pilot survey, it was decided to use a special form for construction activities.

The main points in the questionnaire are:

1. Identification: establishment number, ISIC number, name
2. Quantity of industrial waste generated per year distributed among the different components
3. Quantity of hazardous waste generated per year
4. Management of industrial waste from own activities
5. Management of hazardous waste from own activities
6. Quantity of packaging
7. Methods of calculation
8. Time taken to fill in the questionnaire
9. Comments on the questionnaire

The composition of the waste

As far as the composition and sorting of the waste was concerned, the following categories of materials were chosen for the oil extraction, mining and quarrying and manufacturing industries:

Paper	Cardboard	Plastic
Glass	Tyres	Rubber (excluding tyres)
Iron and other metals	Food, slaughterhouse and fish	Wood wastes
Textiles	Stone, gravel and concrete	Ash
Slag	Dust	Sludge
Chemicals	Other	Mixed, unknown

For construction the classification considers the Sfb-system (Standard for building materials):

Paper	Cardboard	Plastic
Glass	Tyres	Rubber (excluding tyres)
Iron and other metals	Food wastes	Wood wastes and chipboard
Textiles	Glass wool/mineral wool	Stone, gravel and concrete
Tiles	Asphalt	Chemicals
Asbestos	Other	Mixed, unknown

This classification of materials is a more detailed version of the classification used by SN for municipal waste, and corresponds very well with SFT's proposal for classification of materials.

It was decided to use the same classification of hazardous waste as used by NORSAS (1992) (NORSAS stands for the Norwegian competence centre for waste and recycling). A few hazardous waste categories of little relevance were omitted from the questionnaire for the construction industry.

Management of the waste

The management of waste from own activities was distributed between treatment at external waste treatment facilities or management on the establishment's own premises, possibly in the establishment's own treatment plant. Relevant methods of management were:

- ** Recycling or re-use of materials
- ** Incineration with or without utilization of energy
- ** Biological treatment
- ** Deposition on landfills
- ** Used as fill material
- ** Other

Packaging

A Nordic project to survey types and quantities of waste packaging was started in winter 1992/93, administered by RENDAN A/S, in Denmark. Norway participated through SFT. The survey was based on theoretical calculations performed by Matforsk, Ås. The calculations could be checked by including a question on waste packaging in our survey. For this reason the order of the questions and the classification followed the proposed classification by RENDAN.

6. THE SAMPLE

6.1. Choice and classification of industries

Norway has a large number of oil drilling installations and consequently a large amount of waste from drilling operations. Information has been lacking on how the waste is generated, its quantity, and where and how it is dealt with. SFT was therefore interested in obtaining more information on these matters. The mining industry is diminishing steadily, but what is left of it generates large amounts of waste.

The pilot survey performed in 1993 showed that manufacturing industry generates large quantities of waste, and that the representatives of this industry are willing to provide information. The sample was therefore extended to include all branches of industry within ISIC major division 3.

The primary industries were omitted on this occasion for two reasons; 1) methodological problems, and 2) the fact that they are not included in the statistics on waste from other countries. Trade, office activities and service industries are strongly dominated by small establishments. Furthermore, the waste generated in these groups of economic activities is mainly included in the municipal waste and probably consists predominantly of paper. Therefore these groups have also been omitted. Transport was not included because waste is not the main problem in this connection. The most serious problem here is pollution caused by emissions to air, which are covered by other statistics.

Therefore, after consultations with SFT, the following industries received priority in this survey (ISIC = International Standard Industrial Classification):

ISIC	Division
2	Oil extraction, mining and quarrying
2 2	Extraction of crude oil and natural gas
2 3	Metal ore mining
2 9	Other mining
3	Manufacturing
3 1	Manufacture of foods, beverages and tobacco products
3 2	Manufacture of textiles, wearing apparel, leather and leather products
3 3	Manufacture of wood and wood products, including furniture
3 4	Manufacture of paper and paper products, printing and publishing
3 5	Manufacture of chemicals and of chemical petroleum, coal, rubber and plastic products
3 6	Manufacture of mineral products
3 7	Manufacture of basic metals
3 8	Manufacture of fabricated metal products, machinery and equipment
3 9	Other manufacturing industries
5	Construction
5 0	Construction

6.2. Size of establishment and grouping by size

One of the conclusions from the pilot survey was that small establishments (< 5 employees) generate only small quantities of waste. It was therefore suggested that small establishments should not be included in a comprehensive survey. However, in spite of this, these establishments were included for sampling reasons. Moreover, it is of interest internationally to find coefficients for calculating quantities of waste. In an effort to establish such coefficients, the establishments were therefore grouped as follows:

- Group 1. Establishments with fewer than 5 employees
- Group 2. Establishments with between 5 and 19 employees
- Group 3. Establishments with between 20 and 499 employees
- Group 4. Establishments with 500 or more employees

6.3. Geographical distribution

Since the intention was to carry out the survey with the help of municipal employees, it was necessary to limit the geographical spread of the establishments in the sample population. Therefore it was decided to select a total of 60 municipalities from which the establishments would be selected.

6.4. Sampling plan and selection

6.4.1. Population and basis for selection

The survey cover activities in major industry division 2; *Oil extraction, mining and quarrying*, major industry division 3; *Manufacturing* and major industry division 5; *Construction*. The main objective was to estimate national totals for these major divisions of industry. It was also desirable to obtain estimates for the main regions of the country. The sample was drawn from Statistics Norway's Establishments Register. The variables taken from the Establishments register were establishment number, industry division, man-years, type of establishment and municipal number. Most of the data were from 1991. The total number of establishments in the sample population was 60,849 (table 1), and 1646 were drawn to constitute the sample.

6.4.2. Sampling plan

A main goal of the survey was to obtain good total figures. Hence, establishments that contributed large quantities of waste should be included with high probability. It is reasonable to assume that the quantity of waste will tend to be positively correlated with sales and number of employees. In this survey, the number of man-years was used as a measure of size of the establishment, and the selection probabilities are proportional to this variable. At the time the establishments were drawn, a correlation between waste and sales had not been established. Therefore, using sales as a measure of size was not considered.

A two-stage sampling plan was employed: 60 municipalities were selected during the first stage, and establishments were drawn from these municipalities. Lindås municipality, where Statoil and the Mongstad refinery are located, was selected with probability equal to 1. In this connection, the Norwegian sector of the North Sea was defined as a municipality, and was also selected with a probability equal to 1.

Establishments of the same size should have approximately the same probability of being selected. It is necessary to draw more establishments from municipalities with a probability of selection equal to 1, in order to ensure that these establishments have the same probability of being selected as establishments of the same size in municipalities with a selection probability of less than 1. It was decided to select 55 establishments in municipalities with a selection probability equal to 1, and 30 establishments in municipalities with a lower probability of being selected. This means that establishments in municipalities with a probability of selection equal to 1 were more likely to be selected for the sample. Another intended effect was that more large establishments would be included in the sample, which conforms with Statistics Norway's policy of not burdening small establishments with too many surveys.

Table 1. Population. Number of establishments within the industry divisions concerned, by size of establishment. The whole country.

ISIC	Division*	Number of employees				
		Total	0-4	5-19	20-499	500 or more
22	Extraction of oil and gas	109	75	5	19	10
23	Metal ore mining	12	3	-	8	1
29	Other mining	708	538	137	33	-
31	Food, beverage, tobacco industry	2787	1311	890	581	5
32	Textiles industry	1626	1317	179	130	-
33	Wood products manufacturing	3702	2865	566	271	-
34	Pulp and paper processing	3654	2628	698	318	10
35	Plastics/chemical industry	967	554	219	189	5
36	Mineral products manufacturing	966	699	178	89	-
37	Basic metals manufacturing	140	44	23	63	10
38	Manufacture metal products etc.	7565	5471	1226	847	21
39	Other manufacturing	893	784	67	42	-
50	Construction	37718	33604	3303	805	6
Total		60849	49893	7491	3397	68

* For reasons of space, the names of the industry divisions have been abbreviated.

6.4.2.1. Stage 1 of the sampling

58 municipalities were selected during the first stage. Each municipality had a selection probability proportional to the number of man-years in the municipality in the major industry divisions 2, 3 and 5. As mentioned above, Lindås and the Norwegian sector of the North Sea were also included. This implies that municipalities where a large number of persons were employed in these sectors of industry, had a greater chance of being included. The municipalities with the largest number of employees had a probability equal to 1.

Let $X(k)$ be the total number of man-years in sectors 2, 3 and 5 in municipality k , and let X be the total number of man-years in these industrial sectors in the population. The number of municipalities that are selected, is denoted by n . The selection probability is then calculated using the algorithm:

$$\pi(k) = n * X(k) / X$$

When $\pi(k) > 1$, the selection probability is defined to be 1. The municipalities that achieve a selection probability of 1 are "removed from the sampling list", n is reduced accordingly, and $\pi(k)$ is re-calculated. This procedure is repeated until no municipalities with a selection probability equal to 1 remain. The municipalities that have been removed from the sampling list are included in the sample (selection probability equal to 1) and the probability of selection for the remainder has been calculated by means of the algorithm. The selection algorithm includes a geographical stratification by sorting the municipalities by municipal number, that is to say, a systematically equal interval selection (figure 1).

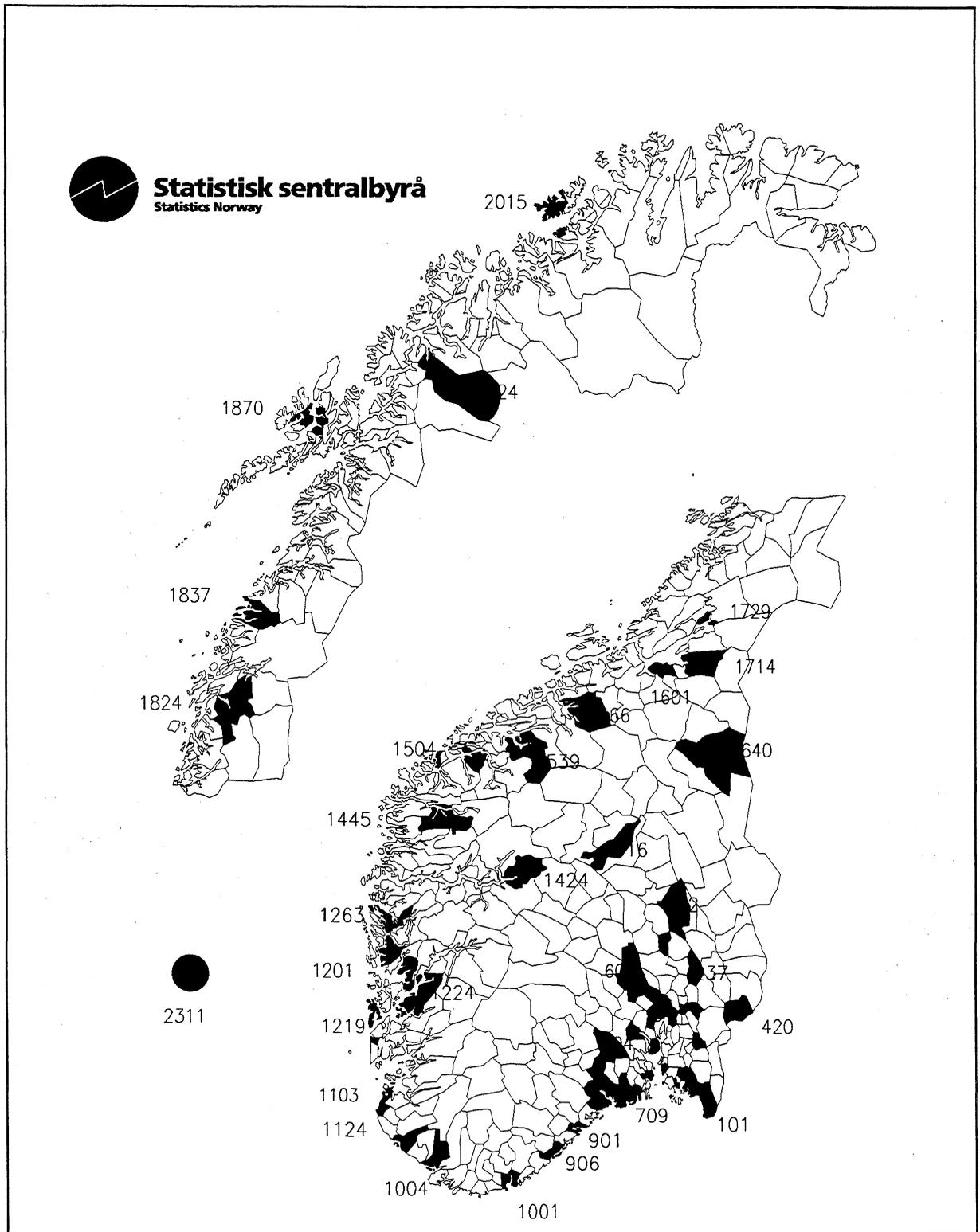


Figure 1. Selected municipalities. The Norwegian part of the continental shelf south of latitude 62°N was also included (= no. 2311).

6.4.2.2. Stage 2 of the sampling

Table 2 shows the population from which the sample was to be drawn. At stage 2, the establishments are selected separately in each municipality. Fifty-five establishments were selected from the municipalities with probability equal to 1, and 30 establishments were selected from each of the remaining municipalities. In some of the municipalities the number of establishments was lower in actual fact than the number that should have been included according to plan. In such cases all the establishments in the municipality were included in the sample, or in other words: all establishments in the municipality obtained a selection probability equal to 1. Establishments with 0 man-years were not included.

Table 2. Population. Number of establishments within the industry divisions concerned, by size of establishment. Total in the 60 selected municipalities.

ISIC	Division	Number of employees				
		Total	0-4	5-19	20-499	500 or more
22	Extraction of oil and gas	83	55	3	15	10
23	Metal ore mining	1	1	-	-	-
29	Other mining	204	130	59	15	-
31	Food, beverage, tobacco industry	1093	485	342	261	5
32	Textiles industry	708	582	74	52	-
33	Wood products manufacturing	1221	970	172	79	-
34	Pulp and paper processing	2329	1641	474	206	8
35	Plastics/chemicals industry	476	259	112	100	5
36	Mineral products manufacturing	397	290	68	39	-
37	Basic metals manufacturing	69	22	11	30	6
38	Manufacture metal products etc.	3429	2379	604	431	15
39	Other manufacturing	442	381	40	21	-
50	Construction	15414	13508	1421	479	6
Total		25866	20703	3380	1728	55

The probability of an establishment being selected is proportional to its size in terms of man-years. The selection algorithm is the same as described for the municipalities. The units are again sorted in the list from which the sample is to be drawn, this time with regards to industry division. This has the same stratifying effect as before.

6.4.2.3. Reduction of the number of small establishments

After the sample had been selected, it was assessed as containing too many small establishments, since it included 469 establishments with fewer than 5 employees. This number was reduced to a third by random selection among the 469 establishments concerned. Thus the probability of establishments of this size being finally selected for inclusion in the sample, was also reduced by a third compared with the initial probability. The total sample is shown in table 3.

Table 3. Number of establishments in the sample.

ISIC	Division	Number of employees				
		Total	0-4	5-19	20-499	500 or more
22	Extraction of oil and gas	24	-	3	11	10
23	Metal ore mining	1	1	-	-	-
29	Other mining	24	4	13	7	-
31	Food, beverage, tobacco industry	260	8	94	153	5
32	Textiles industry	55	7	15	33	-
33	Wood products manufacturing	141	15	64	62	-
34	Pulp and paper processing	170	12	45	105	8
35	Plastics/chemicals industry	99	3	22	69	5
36	Mineral products manufacturing	51	5	22	24	-
37	Basic metals manufacturing	29	1	2	20	6
38	Manufacture metal products etc.	452	31	136	271	14
39	Other manufacturing	25	5	8	12	-
50	Construction	314	74	118	119	6
61	Wholesale and retail trade	1	-	1	-	-
Total		1646	166	543	886	51

6.5. Methods of estimation

6.5.1. Estimators

Using inverse selection probability as a method of estimation implies that every observation in the sample is weighted by the ratio between the number of units in the population and the number of units in the sample.

A ratio estimator means using some variable from a register, for example, sales or number of employees in each establishment, and weighting each observation in the sample by the ratio between total sales (or total number of employees) in the population and total sales (or total number of employees) in the sample.

Given a high degree of correlation between this variable and the variable in the sample, a ratio estimator will correct for the fact that the sample may contain too many small or too many large establishments.

As mentioned above, the data are to be weighted in order to obtain estimates at the national level for major divisions of industry level. It was therefore decided to post-stratify by major industry division. A positive correlation was found between quantity of waste and sales, and between quantity of waste and number of man-years. Due to the fact that no activity at an establishment (measured in terms of number of man-years and sales), results in no waste at all being generated, it is reasonable to assume that a regression line for production/consumer waste and hazardous waste respectively in relation to both variables will pass through the origin. This implies that the ratio estimator is a reasonably good estimator.

In selecting an explanatory variable for the ratio estimator a study was made of the correlation between production/consumer waste and sales, number of man-years and both sales and man-years respectively. This was done because a much larger number of establishments generate production/consumer waste than those which generate hazardous waste. Table 4 shows the correlation between production/consumer waste and man-years and sales at the establishment.

In general, the quantity of waste is more strongly correlated to sales than to number of man-years. In spite of this, we decided to use the number of man-years as the explanatory variable in the ratio estimator. This was because the weights differed only slightly and, in the case of many of the establishments, the sales figures were not recorded in the Establishments Register. No satisfactory model was found for *Manufacturing of basic metals* or for *Construction*. It is difficult to find a good model for *Construction*, since much of the waste is left behind at the building site and thus becomes the developer's (client's) responsibility. There is also a weaker correlation between the reported quantity of waste and the size of the establishment.

Table 4. Correlation between quantities of production waste/consumer waste and sales, man-years and sales and man-years respectively.

ISIC	Division	Explanatory variable		
		Sales	Man-years	Sales and man-years
22	Extraction of oil and gas	.48	.50	.59
29	Metal ore mining	.92	.26	.92
31	Food, beverage, tobacco industry	.30	.30	.32
32	Textiles industry	.75	.39	.84
33	Wood products manufacturing	.41	.37	.41
34	Pulp and paper processing	.73	.59	.73
35	Plastics/chemicals industry	.17	.35	.35
36	Mineral products manufacturing	.50	.40	.51
37	Basic metals manufacturing	.0	.0	.0
38	Manufacture metal products etc.	.78	.81	.96
39	Other manufacturing	.96	.81	.96
50	Construction	.0	.0	.0

Due to the large variation in the model for waste, given the number of man-years, the different major industry divisions were grouped into size categories when calculating the ratio estimator.

6.5.2. Weights for extreme observations

Two establishments showed extreme observations for one type of waste. The weights for these were adjusted by giving the establishment itself a weight of 1 when estimating this kind of waste. Further, the weights for the other establishments were adjusted to final figures for the population, excluding this establishment. Or more precisely; let $X'(s)$ be the

sum of the man-years in the sample, excluding the establishment with this extreme observation, and X' the corresponding variable for the population, excluding the establishment. The weight is then $X'/X'(s)$.

7. IMPLEMENTATION

7.1. Courses for interviewers

Three courses were arranged, in Oslo, Stavanger and Stjørdal respectively. SN invited the interviewers to study the questionnaire and discuss various questions and problems. This review took five hours in each place.

7.2. Mailing of the questionnaire

All the questionnaires were mailed on 3 February (except in the case of Oslo, where the mailing was postponed for 2 weeks owing to delay in selecting the sample), with a request to respond by 15 April. The questionnaire was accompanied by a letter signed by the Director General of Statistics Norway. This stated that the establishments were free to choose whether to receive an interviewer or not, but that it was compulsory to fill in the questionnaire. The establishments that did not wish to be interviewed had to fill in the questionnaire themselves and mail it to SN by the specified deadline.

7.3. Mailed reminders

Four weeks after the deadline had expired (13 May) a reminder was mailed to the establishments that had not yet returned the questionnaire. A total of 184 establishments were given a new deadline, 1 June. Two weeks after this deadline had expired (15 June) a second reminder was mailed to 72 establishments, with a final deadline of 1 July. A new questionnaire was enclosed with both reminders.

After the first deadline had expired on 13 May, it was no longer possible for the establishments to receive help from an interviewer. They had to reply by mail.

No further reminders were sent, and it was decided not to exercise the right to impose a coercive fine.

7.4. Auditing and recording the data

The audit was undertaken by thoroughly reviewing all the returned questionnaires. Two auditors worked full time on this task. In cases where information was lacking or was incorrect, the establishments were contacted by telephone. It was often difficult to reach the person who had actually filled in the questionnaire, which led to many extra telephone calls.

A number of general decisions had to be taken concerning which "boxes" should be used for certain waste categories and components that had not been included in the list beforehand.

Many establishments had stated quantities - of waste oil in particular - in terms of volume. NORSAS was contacted in order to obtain factors to convert the volume into weight (conversion factors), but they used the ratio 1:1. We decided to use a conversion factor of 0.9 for oil, and 1.2 for paint, glue and varnish (Statistics Finland).

Another major problem had to do with the quantities of acids and alkalis, some of which were stated as concentrated quantities and some as diluted quantities, with no specification of the actual concentration. NORSAS had no solution to this problem: They recorded quantities of acid and alkalis with water, and the same was done here.

Acids and alkalis that the establishments diluted themselves and discharged into the municipal waste water system are recorded under *Hazardous waste, managed on own premises*. Chemicals and other diluted wastes that are not classified as hazardous waste and are discharged into the public waste water system are recorded under the title *Managed on own premises*.

Washing water that is delivered as hazardous waste and water, is recorded under *Hazardous waste, delivered to an approved external treatment facility*, and includes all the water.

In the case of rinsing water that is passed through the establishment's own treatment plant, only the remaining sludge is recorded, under *Hazardous waste, delivered to an approved external treatment facility*.

After consultation with NORSAS, photographic chemicals and photographic paper are recorded under *Other inorganic waste*.

Sludge containing heavy metals is recorded under *Heavy metals*, even if the sludge contains mainly organic material. This applies in particular to waste from the pulp and paper processing industry.

A special registration program and data bases founded on QBE-vision were prepared for this survey. Different registration programs and data bases (Excel spread sheets) were prepared for each questionnaire. The data were recorded by one of the auditors.

8. RESULTS AND DISCUSSION

8.1. Drop-out and response rate

One of the municipalities (Bømlo) had to be omitted because neither the municipality nor SN had the capacity to undertake the interviews.

In four other municipalities (Vefsn, Eidsvoll, Ringerike and Tønsberg) SN had to undertake the interviewing because the municipalities themselves did not have the resources to do so.

A total of 101 questionnaires (6 per cent) were returned blank, either because the establishment had moved, was unknown or had gone bankrupt (table 5). In addition to these, one establishment had been inadvertently included in the sample; its correct industrial code was 61. This establishment was also withdrawn from the sample.

Table 6 shows the gross sample - that is to say, the sample when all unknown/moved/closed down establishments had been subtracted. The net sample is shown in table 7.

An ordinary logistic analysis of response/non-response was carried out, with municipality, industry division, man-year category, rural/urban location and mailed questionnaire/personal interview as influencing variables. The analysis showed that mailed questionnaire/personal interview, man-year category and industry division were significant variables at at least 5 per cent level.

Table 5. Drop-out because establishment was unknown/had closed down/had moved/was wrongly coded, by industry division and size of establishment. Number of establishments.

ISIC	Division	Number of employees				
		Total	0-4	5-19	20-499	500 or more
22	Extraction of oil and gas	2	-	1	-	1
23	Metal ore mining	-	-	-	-	-
29	Other mining	4	-	3	1	-
31	Food, beverage, tobacco industry	8	-	3	5	-
32	Textiles industry	1	-	-	1	-
33	Wood products manufacturing	5	1	3	1	-
34	Pulp and paper processing	11	2	2	7	-
35	Plastics/chemicals industry	5	-	-	5	-
36	Mineral products manufacturing	2	1	-	1	-
37	Basic metals manufacturing	2	1	1	-	-
38	Manufacture metal products etc.	25	4	9	12	-
39	Other manufacturing	1	1	-	-	-
50	Construction	34	13	9	11	1
61	Wholesale and retail trade	1	-	1	-	-
Total		101	23	32	44	2

The reminder that was sent to 184 establishments 4 weeks after the deadline had expired, produced 111 replies. A further 40 replies were received after the second reminder. This implies that 10 per cent of the establishments that responded did so after receiving a reminder. The drop-out was therefore 33 (2.1 per cent).

Table 6. Gross sample, by industry division and size of establishment. Number of establishments.

ISIC	Division	Number of employees				
		Total	0-4	5-19	20-499	500 or more
22	Extraction of oil and gas	22	-	2	11	9
23	Metal ore mining	1	1	-	-	-
29	Other mining	20	4	10	6	-
31	Food, beverage, tobacco industry	252	8	91	148	5
32	Textiles industry	54	7	15	32	-
33	Wood products manufacturing	136	14	61	61	-
34	Pulp and paper processing	159	10	43	98	8
35	Plastics/chemical industry	94	3	22	64	5
36	Mineral products manufacturing	49	4	22	23	-
37	Basic metals manufacturing	27	-	1	20	6
38	Manufacture metal products etc.	427	27	127	259	14
39	Other manufacturing	24	4	8	12	-
50	Construction	280	61	109	108	2
Total		1545	143	511	842	49

Table 7. Net sample, by industry division and size of establishment. Number of establishments.

ISIC	Division	Number of employees				
		Total	0-4	5-19	20-499	500 or more
22	Extraction of oil and gas	22	-	2	11	9
23	Metal ore mining	1	1	-	-	-
29	Other mining	20	4	10	6	-
31	Food, beverage, tobacco industry	242	7	89	141	5
32	Textiles industry	52	6	14	32	-
33	Wood products manufacturing	129	13	58	58	-
34	Pulp and paper processing	155	10	42	95	8
35	Plastics/chemical industry	93	3	21	64	5
36	Mineral products manufacturing	48	3	22	23	-
37	Basic metals manufacturing	27	-	1	20	6
38	Manufacture metal products etc.	411	27	117	253	14
39	Other manufacturing	24	4	8	12	-
50	Construction	263	55	105	101	2
Total		1487	133	489	816	49

The selection of the one establishment in division no. 23 was unfortunate; it turned out to be an office establishment and reported that it did not generate any waste. Since the establishment was not representative of the division as such and, in addition, the sample contained only one establishment representing this division (which is unrepresentative in itself), this establishment was excluded from the sample. For this reason, no figures are presented for division 23; *Metal ore mining*.

A total of 333 establishments (22.4 per cent) did not wish to be interviewed and replied by mail. Of these establishments, 44 first replied by mail and then afterwards received an interviewer. In other words, two questionnaires exist for these establishments, but the data recorded were the data collected via the interview, since they were more specific than the data received first by mail.

8.2. Sampling

8.2.1. Significance of a two-stage sampling design

The sampling design limited the sample to 60 municipalities. Statistically, it would have been better to select the sample of establishments from the whole population. However, collecting data from a smaller number of municipalities took less time and reduced costs.

The so-called design effect would have provided a measure of the effect of the sampling design. However, these calculations would have implied much time spent on programming (since in this case it is not a trivial matter to calculate this effect). Selecting proportionally with a measure for size of establishment compensates to some extent for the disadvantage of a two-stage sampling procedure. It ensures that the sample includes a large number of establishments that generate large quantities of waste.

For later surveys, a scheme should be developed for calculating a measure which would show just how good the sampling design and the estimators are. One possibility is to prepare a simulation scheme, so that the design effect, for example, could be calculated by simulation.

8.2.2. Problems of demarcation

Selection by establishment no. often led to serious problems of demarcation for multi-establishment enterprises. It was often difficult for them to discriminate waste from a single establishment (or several of them), as was intended. For many establishments, our stratification of establishments appeared illogical, and it was often difficult to find out which was the proper unit, or establishment, to fill in the questionnaire. This situation obviously represented a source of error, and was the most serious problem encountered in the whole survey.

In some cases, the establishment undertook activities in other municipalities than those that had been included in the sample. In such cases (and in general), it was decided that the waste should refer to the establishment as such. This means that the figures apply across municipal boundaries, which implies in turn that the figures at municipal level are of no significance, and are not worth publishing.

Small establishments (0-4 employees) generated less waste per establishment than larger establishments did, and the total quantity of waste from these small establishments accounted for about 6.3 per cent of the total waste from industry divisions 2, 3 and 50. Small establishments accounted for 0.7 of the total quantity of hazardous waste generated within the same divisions of industry. In general, the burden of filling in a questionnaire is

greatest for small establishments, and it was these who commented negatively on the scope of the questionnaire.

8.3 Interview

Four of the municipalities had done such a bad job that SN had to contact 81.3 per cent of the establishments by telephone afterwards. There were large variations among the municipalities as regards the number of establishments that did not want to be interviewed. In general, however, the interview method functioned well.

The different interviewers obviously placed varying emphasis on degree of detail. Two of the interviewers tended to place all the waste in the box for *Mixed* waste, while others did not use this box at all.

During the auditing, some of the establishments that had been interviewed were asked what they thought about being interviewed by a municipal employee. None of them had objections in this regard. On the contrary, all the establishments thought that the interview had been pleasant, and that it had been generous of the municipality to help them to fill in the questionnaire. Allegedly, none of them had withheld information because the person who had visited them represented the municipality.

8.4. Auditing

8.4.1. Time spent on auditing

All in all, the auditing took less time than estimated, but there were large variations from one municipality to another. Questionnaires answered by mail required more auditing than questionnaires received via interviewers. An establishment was contacted by telephone only when obvious errors had occurred, or when some of the boxes were left blank. All the establishments showed a will to cooperate and were glad to receive help and discuss problems connected with the generation and management of waste. About 200 questionnaires on average were audited each week.

The quality of the replies is reflected in the time spent on auditing. Of the establishments that returned the questionnaires, 535 (36.7 per cent) had to be contacted by telephone (table 8) for clarifications. In addition, 31 establishments stated that they did not have any waste. More establishments from the oil extraction division had to be contacted than from the other divisions of industry. Quite large differences were again observed among the municipalities, possibly owing to varying competence (and interest) among the interviewers. A total of about 300 hours was spent on auditing the questionnaires.

Because many establishments, and interviewers as well, did not know how the waste was dealt with after it had been placed in a container it was necessary, as part of the auditing, to contact transporters of waste, waste management companies and municipal waste treatment facilities.

Table 8. Number of establishments contacted by telephone during the auditing.

ISIC	Division	Rung-up	
		Number	Per cent
22	Extraction of oil and gas	12	54.5
29	Other mining	5	25.0
31	Food, beverage, tobacco industry	99	40.9
32	Textiles industry	19	37.3
33	Wood products manufacturing	36	28.1
34	Pulp and paper processing	63	40.9
35	Plastics/chemical industry	42	45.2
36	Mineral products manufacturing	22	46.8
37	Basic metals manufacturing	14	51.9
38	Manufacture metal products etc.	138	34.1
39	Other manufacturing	2	8.7
50	Construction	83	34.0
Total		535	36.7

8.4.2. Filling in and understanding the questionnaire

In general, the questionnaire functioned well. None of the establishments or interviewers misunderstood what was meant by generated quantities of waste/hazardous waste. However, in some cases (2.9 per cent) the responses were incomplete because the establishments did not know enough about what waste they actually generated. As a result, they entered all the waste in the box for *Mixed* waste.

A large part of the establishments (42 per cent) had either not filled in block D *Management of waste from own activities*, or had recorded all the waste in the box for *Deposited on landfill*. In addition, 40 establishments stated that they did not generate any production/consumer waste. Upon contacting the waste collection company/municipality, it was found that the waste was treated in several different ways. Only a few of the establishments sorted their own waste. As a rule, the waste was collected by a transport company, which dealt with it in the most suitable way.

70.1 per cent of the establishments had generated hazardous waste in 1993. Of these, 76.4 per cent had filled in the questionnaire satisfactorily and in conformity with information from the waste collection company and/or the municipality (table 9).

21.4 per cent of the establishments had omitted to specify how much of the waste consisted of packaging. None of them had misunderstood that the quantities in block F *Quantities of waste packaging* were also included in block B *Quantity of waste from own activities*.

Table 9. Per cent of the establishments that had filled in block E *Management of hazardous waste from own activities* satisfactorily and in conformity with information from the waste collection company and/or the municipality. Before auditing.

ISIC	Division	Number of employees				
		Total	0-4	5-19	20-499	500 or more
22	Extraction of oil and gas	43.8	-	100.0	55.6	16.7
29	Other mining	89.5	100.0	90.0	80.0	-
31	Food, beverages, tobacco industry	81.4	100.0	82.4	80.7	80.0
32	Textiles industry	78.3	-	100.0	76.2	-
33	Wood products manufacturing	83.5	100.0	94.6	72.9	-
34	Pulp and paper processing	70.6	55.6	68.6	72.6	75.0
35	Plastics/chemical industry	72.8	100.0	76.5	75.4	20.0
36	Mineral products manufacturing	83.8	100.0	94.1	73.7	-
37	Basic metals manufacturing	63.0	-	100.0	65.0	50.0
38	Manufacture metal products etc.	73.3	83.3	76.7	72.8	53.8
39	Other manufacturing	93.8	50.0	100.0	100.0	-
50	Construction	81.7	82.4	83.0	80.3	100.0
Total		76.4	82.1	82.1	75.1	52.3

8.5. Time spent by suppliers of the data

The 1321 respondents who had stated how much time they had spent on filling in the questionnaire used a total of 902 hours - including the time taken up by the interviews (table 10). This results in an average of 41.7 minutes per establishment.

Table 10. Average time spent on filling in the questionnaire, by division. Minutes.

ISIC	Division	Minutes
Overall average		41.7
22	Extraction of oil and gas	49.4
29	Other mining	30.3
31	Food, beverages, tobacco industry	45.7
32	Textiles industry	31.1
33	Wood products manufacturing	38.8
34	Pulp and paper processing	42.5
35	Plastics/chemicals industry	52.5
36	Mineral products manufacturing	41.3
37	Basic metals manufacturing	71.4
38	Manufacture metal products etc.	45.5
39	Other manufacturing	39.8
50	Construction	27.7

The amount of time spent varied greatly from one division of industry to another. While establishments engaged in construction used on average less than 28 minutes, establishments in the basic metals manufacturing industry spent 71 minutes on the same job. Another difference that came to light was that the larger the establishment, the larger was the time devoted to the survey; While small establishments spent on average 20 minutes on the questionnaire, the larger establishments used about 69 minutes to answer the questions (table 11).

Table 11. Average time spent on filling in the questionnaire, by size of establishment. Minutes.

Size category	Minutes
Overall average	41.7
0-4	20.3
5-19	31.3
20-499	49.7
500 or more	68.8

8.6. Main figures for quantities of waste

The starting point was that these statistics would be based on information from the generators of the waste. The figures have therefore not been adjusted in the light of other information sometimes obtained from the transporter of the waste, a waste sorting facility or a landfill.

The figures that have been produced are based mainly on estimated quantities of waste. 49 per cent of the establishments stated that the reported quantities were based on experience or estimates, 8 per cent stated that they were based on weighing, 4 per cent stated that they were based on converting volume into weight, and 32 per cent stated that the quantities had been arrived at by weighing, conversion of the figures, and estimates. 7 per cent had not answered this question.

When the figures were weighted in order to estimate the distribution for Norway as a whole, it was calculated that the divisions of industry included in this survey generated a quantity of about 11,600,000 tonnes of waste as a whole. The total quantity of hazardous waste was 328,200 tonnes (table 12). The largest quantities of waste were generated by establishments with between 20 - 499 employees (tables 13 and 14).

It is important to note that there are some serious uncertainties connected to the figures. This applies in particular to the industries in division 2; *Oil extraction, quarrying and mining*, and division 5; *Construction*. The main reason for the uncertainty is that the sample was too small (especially for division 2). For division 5, the uncertainty is mainly due to the fact that it was often impossible to find the "owner" of the waste; Much of the waste was left behind at the construction site and became the responsibility of the

developer or client. For both these industries, therefore, the amounts of waste should probably be much higher.

Table 12. Total quantities of production and consumer waste and of hazardous waste, by division. Rounded off figures. Tonnes

ISIC	Division	Total	Production and consumer waste	Hazardous waste
22	Extraction of oil and gas	31 000	28 000	3 000
29	Other mining	4 696 000	4 695 000	600
31	Food, beverages, tobacco industry	594 000	591 000	3 000
32	Textiles industry	16 000	16 000	200
33	Wood products industry	432 000	431 000	800
34	Pulp and paper processing	1 035 000	1 029 000	6 100
35	Plastics/chemicals industry	344 000	100 000	243 900
36	Mineral products manufacturing	134 000	134 000	300
37	Basic metals manufacturing	505 000	454 000	50 700
38	Manufacture metal products etc.	224 000	209 000	15 100
39	Other manufacturing	3 000	3 000	0
50	Construction	3 578 000	3 574 000	4 400
Total		11 592 000	11 264 000	328 200

Table 13. Calculated quantities of production and consumer waste, by size of establishment and division. 1993. Rounded off figures. Tonnes

ISIC	Division	Total	Number of employees			
			0-4	5-19	20-499	500 or more
22	Extraction of oil and gas	28 000	-	0	3 000	25 000
29	Other mining	4 695 000	4 000	213 000	4 478 000	-
31	Food, beverages, tobacco industry	591 000	18 000	233 000	332 000	8 000
32	Textiles industry	16 000	200	2 000	14 000	-
33	Wood products manufacturing	431 000	31 000	69 000	331 000	-
34	Pulp and paper processing	1 029 000	4 000	12 000	885 000	128 000
35	Plastics/chemicals industry	100 000	600	23 000	69 000	7 000
36	Mineral products manufacturing	134 000	0	36 000	98 000	-
37	Basic metals manufacturing	454 000	-	0	378 000	76 000
38	Manufacture metal products etc.	209 000	12 000	42 000	93 000	62 000
39	Other manufacturing	3 000	0	600	2 000	-
50	Construction	3 574 000	658 000	2 146 000	770 000	0
Total		11 264 000	729 800	2 776 600	7 453 000	306 000

Table 14. Calculated quantities of hazardous waste, by size of establishment and division. 1993. Rounded off figures. Tonnes

ISIC	Division	Number of employees				
		Total	0-4	5-19	20-499	500 or more
22	Extraction of oil and gas	3 000	-	100	400	2 500
29	Other mining	600	0	200	300	-
31	Food, beverages, tobacco industry	3 000	0	200	2 800	0
32	Textiles industry	200	-	0	200	-
33	Wood products manufacturing	800	0	100	700	-
34	Pulp and paper processing	6 100	100	500	5 200	300
35	Plastics/chemicals industry	243 900	0	25 900	210 200	7 800
36	Mineral products manufacturing	300	0	100	200	-
37	Basic metals manufacturing	50 700	-	100	18 200	32 400
38	Manufacture metal products etc.	15 100	400	1 000	11 900	1 900
39	Other manufacturing	0	0	0	0	-
50	Construction	4 400	1 800	1 700	900	0
Total		328 200	2 400	29 900	251 000	44 900

9. CONCLUSIONS

The conclusions from the survey can be listed as follows:

- ** The questionnaire functioned satisfactorily.
- ** In general, the municipal employees did a good job as interviewers.
- ** The establishments are willing to provide information on their waste; the response rate was 98 per cent.
- ** The establishments have satisfactory knowledge of the waste that they generate. On the other hand, knowledge of how it is treated is generally lacking.
- ** Answers were received to questions relating to quantities of hazardous waste. Consequently, hazardous waste should also be included in future surveys on waste.
- ** Small establishments generate only small quantities of waste.
- ** The Establishments Register can be used, even if it is not completely up-to-date, when the establishments are stratified by type of establishment (main establishment/single establishment/other establishment/auxiliary department).
- ** Some of the figures are highly uncertain. This applies in particular to the industries in division 2; *Oil extraction, quarrying and mining*, and division 5; *Construction*. The main reason for the uncertainty is that the sample was too small (especially for

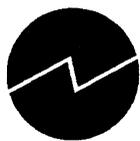
division 2). For division 5 the uncertainty is mainly due to the fact that it was often impossible to find the "owner" of the waste; Much of the waste was left behind at the construction site and became the responsibility of the developer or client.

** A positive correlation was found between quantity of waste and size of establishment. In spite of this, the results from this survey do not provide a basis for calculating unambiguous coefficients for the relation between quantity of waste and number of employees. For this, the standard deviations were too large.

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Data on waste and recycling 1993

Oil extraction / mining and quarrying and manufacturing industry

The data are collected by authority of Act no. 54 of 16 June 1989 relating to official statistics and Statistics Norway

This questionnaire has been sent to 1,650 establishments distributed among 60 municipalities. These establishments have been selected (by a specific method) to participate in a survey for the purpose of procuring national statistics on waste and recycling in industry.

NB! Waste that is re-used in its original form or for recycling of materials on own premises shall not be included.

Thank-you for your help.

A. Identification					
Name of establishment	001	Postal code	003	Postal district	004
Address of establishment	002	Contact:	005	Tel:	006
B. Quantity of industrial waste from own activities (Including packaging, excluding hazardous waste)			C. Quantity of hazardous waste from own activities		
Component (material)	Tonnes		Category	Kg	
Paper	007		Waste oil, lubricating oil etc.	028	
Cardboard	008		Oily waste from separators	029	
Plastic	009		Oil drilling cuttings and fluids	030	
Glass	010		Oil emulsions	031	
Tyres	011		Halogenated organic solvents	032	
Rubber (excl. tyres)	012		Non-halogenated organic solvents	033	
Iron and other metals	013		Paint, glue, varnish and printer's ink	034	
Food, slaughterhouse and fish wastes	014		Distillation residues and tarry waste	035	
Wood wastes	015		Waste cont. heavy metals/batteries	036	
Textiles	016		Waste containing cyanide	037	
Stone, gravel and concrete	017		Discarded pesticides	038	
Ash	018		Waste containing PCB	039	
Slag	019		Isocyanates	040	
Dust (e.g. filter/coal dust)	020		Other organic wastes	041	
Sludge	021		Strong acids	042	
Per cent dry matter	022		Strong alkalis	043	
Chemicals	023		Other inorganic wastes	044	
Other, specify			Aerosol cans	045	
	024		Laboratory wastes	046	
	025		Other, specify		
Mixed, unknown	026			047	
			Mixed, unknown	048	
Total	027		Total	049	

D. Disposal of industrial waste (i.e. production and consumer waste) from own activities (Including waste packaging)						
		Component		Tonnes		Delivered to (Name of recipient)
Treated at an external facility	Recycling of materials and/or re-use	050		051		052
		053		054		055
		056		057		058
		059		060		061
		062		063		064
	Incineration with utilization of energy	065		066		067
		068		069		070
	Incineration without utilization of energy			071		072
	Biological treatment			073		074
	Deposited on landfill			075		076
	Used as fill material			077		078
	Other, specify					
			079		080	
Managed on own premises	Incineration with utilization of energy	081		082		Comments
		083		084		
	Incineration without utilization of energy			085		
	Biological treatment			086		
	Deposited on landfill			087		
	Used as fill material			088		
	Other, specify					
			089			
Total (= box 027)				090		
E. Disposal of hazardous waste from own activities						
		Category of hazardous waste		Kg		Delivered to (Name of recipient)
Delivered to approved external treatment facility	091		092		093	
	094		095		096	
	097		098		099	
	100		101		102	
	103		104		105	
	106		107		108	
	109		110		111	
Managed on own premises	Method of management					
	112		113		114	
	115		116		117	
	118		119		120	
Total (= box 049)				121		

F. Quantities of waste packaging (Specified data)		G. How has the quantity of waste been calculated?	
Component	Tonnes	The reported figures for quantities of waste are based on (indicate by an X):	
Paper	122	Weighing the waste	1 <input type="checkbox"/>
Cardboard	123	Conversion from volume to weight	2 <input type="checkbox"/>
Plastic	124	Earlier experiences/estimates	3 <input type="checkbox"/>
Glass	125	Combination of more than one method	4 <input type="checkbox"/>
Wood	126	H. Conversion factors	
Textiles	127		
Iron and other metals	128	If the figures were converted from volume to weight, what conversion factors were used?	
Other, specify	129	<div style="border: 1px solid black; height: 60px; width: 100%;"></div>	
Mixed, unknown	130		
Total	131		
I. Comments			
State how long it took to fill in the questionnaire (minutes):		Was it difficult to answer questions owing to lack of data?	
<input type="text" value="133"/> 133		<i>Indicate by an X</i> 1 <input type="checkbox"/> No 2 <input type="checkbox"/> Yes, what data?	
Were the questions difficult to understand / not clearly worded?		<div style="border: 1px solid black; height: 40px; width: 100%;"></div>	
<i>Indicate by an X</i> 1 <input type="checkbox"/> No 2 <input type="checkbox"/> Yes			
Do you have any other comments on the questionnaire or on the method used to collect the data?			
<div style="border: 1px solid black; height: 40px; width: 100%;"></div>			
What is your impression of the questionnaire (type of information asked for, scope and design)?			
<div style="border: 1px solid black; height: 40px; width: 100%;"></div>			

Guidelines on how to fill in the questionnaire on waste and recycling

Definitions:

Waste: Discarded objects or substances. Waste also includes superfluous objects and substances from service activities, waste water treatment plants etc.

Waste component: The share of the quantity of waste that has the same material properties. The word "material" is used synonymously. Example: paper, plastic, glass, etc.

Biological treatment: Composting (aerobic) or allowing to rot (anaerobic) of organic waste.

Landfill: A regulated (approved) site for depositing waste.

Disposal: Management of waste on the establishment's own premises or externally. The waste can be recycled, incinerated, treated biologically or deposited.

Recycling: To use the waste and other residual products. We distinguish between three forms of recycling:

Re-use: Using the waste again in its original form.

Recycling of materials: Utilization of waste so that the material is wholly or partly retained. The waste can be used as raw material for similar products or can be converted into other kinds of products.

Energy utilization: Utilization of the energy in the waste by means of incineration, pyrolysis etc.

Hazardous waste: Waste which cannot be appropriately treated together with consumer waste because it may lead to serious pollution or risk of injury to persons or animals.

How to fill in the different items, or "boxes", in the questionnaire.

The data apply to 1993.

B. Quantity of industrial waste from own activities (Including waste packaging, excluding hazardous waste)

Waste that should not be reported in block B.

- Hazardous waste. (Hazardous waste shall be reported in block C.)
- Waste that is used again or for recycling of materials on own premises.

Waste that should be reported in block B.

- All other waste from the establishment, including waste from canteen and administration, and waste that is delivered for re-use or recycling externally.
- Note that packaging shall be included in industrial waste.

Because the same questionnaire is used for several industry divisions, some of the waste components may be irrelevant for your establishment.

Box 022 shall be used to report the percentage of dry matter in any sludge produced at the establishment.

Chemicals, box 023, refers to chemicals that are not hazardous waste, e.g. sugar, sodium chloride, calcium, commercial fertilizer.

If the waste from the establishment contains other components than those included in the list, these components shall be specified under *Other, specify*, and the quantity reported in box 024 to box 025. If the waste is mixed and it is impossible to estimate the quantity of the different components, the total quantity shall be reported under *Mixed, unknown*, box 026.

C. Quantities of hazardous waste from own activities

This block is to be used to report the quantities of hazardous waste generated at the establishment. (See definitions).

The term *pesticides* includes fungicides, insecticides and other pest-killing agents.

If the establishment has hazardous waste that cannot be placed in one or other of the listed categories, the content of this waste shall be specified under *Other, specify*, and the quantities shall be reported in box 047.

If the hazardous waste is mixed and it is impossible to estimate the quantities of the different categories, the quantity shall be reported under *Mixed, unknown*, box 048.

NB! The quantity of hazardous waste shall be reported in kilograms.

D. Disposal of industrial waste from own activities (Including waste packaging)

In this block, the waste shall be distributed according to how it was disposed of: whether it was recycled, burned, treated biologically, deposited on a landfill or disposed of in some other way. You are asked to distinguish between waste that was treated at an external facility and waste that was managed on your own premises/treated in your own plant.

Waste that is used for recycling of materials or is used again (re-use) shall be reported only if the waste in question is delivered to an external facility/enterprise (cf. B). Recycling of materials may mean, for example, that waste from a food manufacturing establishment is used as raw material in a glue factory. Re-use may be, for example, use of returned bottles.

If waste from the establishment is stored temporarily or disposed of in other ways, the quantity of this waste should be reported under *Other, specify*, box 079 (external facility) and/or box 089 (own premises/treatment plant). Specify how this waste was disposed of.

The number of tonnes of industrial waste reported in box 090 shall be equal to the number of tonnes of industrial waste reported in box 027.

E. Disposal of hazardous waste from own activities

The hazardous waste shall be reported under the same categories as in block C. State the name of the recipient or transport company that has dealt with the waste. Under *Managed on own premises*, you should state the method of disposal employed. If the establishment has temporarily stored some of the hazardous waste that was generated in 1993, then the quantity stored should be reported under *Managed on own premises*. The number of kilograms of hazardous waste reported in box 121 should be equal to amounts reported in box 049.

F. Quantities of waste packaging (Specified data)

This block is for reporting the share of the waste that is/has been packaging. Thus the quantity of waste packaging is part of the quantity of industrial waste reported in block B. If the waste packaging consisted of components other than those listed under F in the questionnaire, this shall be specified under *Other, specify*, box 129. If the waste packaging was mixed and it is impossible to estimate the quantity of the different components, the total quantity shall be reported under *Mixed, unknown*, box 130.



Data on waste and recycling 1993

Construction

The data are collected by authority of Act no. 54 of 16 June 1989 relating to official statistics and Statistics Norway

The questionnaire has been sent to about 1,650 establishments distributed among 60 municipalities. These establishments have been selected (by a special method) to participate in a survey for the purpose of procuring national statistics on waste and recycling in industry.

NB! Waste that is re-used in its original form or for recycling of materials on own premises shall not be included.

Thank-you for your help

A. Identification					
Name of establishment	001	Postal code	003	Postal district	004
Address of establishment	002	Contact	005	Tel.	006
B. Quantity of industrial waste from own activities (Including waste packaging, excluding hazardous waste)			C. Quantity of hazardous waste from own activities		
Component (material)	Tonnes		Category	Kg	
Paper	007		Waste oil, lubricating oil etc.	029	
Cardboard	008		Oil emulsions	030	
Plastic	009		Halogenated organic solvents	031	
Glass	010		Non-halogenated organic solvents	032	
Tyres	011		Paint, glue, varnish and printer's ink	033	
Rubber (excluding tyres)	012		Distillation residues and tarry waste	034	
Iron and other metals	013		Waste cont. heavy metals/batteries	035	
Food wastes	014		Waste containing cyanide	036	
Wood wastes and chipboard	015		Discarded pesticides	037	
Textiles	016		Waste containing PCB	038	
Glass wool and mineral wool	017		Isocyanates	039	
Stone, gravel and concrete	018		Other organic wastes	040	
Tiles	019		Strong acids	041	
Asphalt	020		Strong alkalis	042	
Chemicals	021		Other inorganic wastes	043	
Asbestos	022		Aerosol cans	044	
Other, specify			Other, specify		
	023			045	
Mixed, unknown	024			046	
Total	025			047	
How much (in tonnes) of the total waste (box 025) originates from:					048
New building	Rehabilitation	Demolition	Mixed, unknown	049	
026	027	028	Total	050	

**D. Disposal of industrial waste (i.e. production and consumer waste) from own activities
(Including waste packaging)**

		Component		Tonnes		Delivered to (Name of recipient)	
Treated at an external facility	Recycling of materials and/or re-use	051		052		053	
		054		055		056	
		057		058		059	
		060		061		062	
		063		064		065	
	Incineration with utilization of energy	066		067		068	
		069		070		071	
	Incineration without utilization of energy			072		073	
	Biological treatment			074		075	
	Deposited on landfill			076		077	
	Used as fill material			078		079	
	Other, specify						
				080		081	
Managed on own premises	Incineration with utilization of energy	082		083		Comments	
		084		085			
	Incineration without utilization of energy			086			
	Biological treatment			087			
	Deposited on landfill			088			
	Used as fill material			089			
	Other, specify						
			090				
Total (= item 025)				091			

E. Disposal of hazardous waste from own activities

		Category of hazardous waste		Kg		Delivered to (Name of recipient)	
Delivered to approved external treatment facility	092			093		094	
	095			096		097	
	098			099		100	
	101			102		103	
	104			105		106	
	107			108		109	
	110			111		112	
Managed on own premises	Method of management						
	113			114		115	
	116			117		118	
	119			120		121	
Total (= item 050)				122			

F. Quantities of waste packaging (Specified data)		G. How has the quantity of waste been calculated?	
Component	Tonnes	The reported figures for quantities of waste are based on (indicate by an X)	
Paper	123	Weighing the waste	1 <input type="checkbox"/>
Cardboard	124	Conversion from volume to weight	2 <input type="checkbox"/>
Plastic	125	Earlier experiences/estimates	3 <input type="checkbox"/>
Glass	126	Combination of more than one method	4 <input type="checkbox"/>
Wood	127	H. Conversion factors If the figures were converted from volume to weight, what conversion factors were used? <div style="border: 1px solid black; height: 60px; width: 100%;"></div>	
Textiles	128		
Iron and other metals	129		
Other, specify	130		
Mixed, unknown	131		
Total	132	I. Comments State how long it took to fill in the questionnaire (minutes): <input type="text"/> 134	
		Was it difficult to answer the questions owing to lack of data? Indicate by an X 1 <input type="checkbox"/> No 2 <input type="checkbox"/> Yes, what data? <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	
		Were the questions difficult to understand/not clearly worded? Indicate by an X 1 <input type="checkbox"/> No 2 <input type="checkbox"/> Yes <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	
		Do you have any other comments on the questionnaire or on the method used to collect the data)? <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	
		What is your impression of the questionnaire (type of information asked for, scope and design)? <div style="border: 1px solid black; height: 40px; width: 100%;"></div>	

Guidelines on how to fill in the questionnaire on waste and recycling

Definitions:

Waste: Discarded objects or substances. Waste also includes superfluous objects and substances from service activities, waste water treatment plants etc.

Waste component: The share of the quantity of waste that has the same material properties. The word "material" is used synonymously. Example: paper, plastic, glass, etc.

Biological treatment: Composting (aerobic) or allowing to rot (anaerobic) of organic waste.

Landfill: A regulated (approved) site for depositing waste.

Disposal: Management of waste on the establishment's own premises or externally. The waste can be recycled, incinerated, treated biologically or deposited.

Recycling: To use the waste and other residual products. We distinguish between three forms of recycling:

Re-use: Using the waste again in its original form.

Recycling of materials: Utilization of waste so that the material is wholly or partly retained. The waste can be used as raw material for similar products or can be converted into other kinds of products.

Energy utilization: Utilization of the energy in the waste by means of incineration, pyrolysis etc.

Hazardous waste: Waste which cannot be appropriately treated together with consumer waste because it may lead to serious pollution or risk of injury to persons or animals.

How to fill in the different items, or "boxes", in the questionnaire.

The data apply to 1993.

B. Quantity of industrial waste from own activities (Including waste packaging, excluding hazardous waste)

Waste that should not be reported in block B.

- Hazardous waste. (Hazardous waste shall be reported in block C.)
- Waste that is used again or for recycling of materials on own premises.

Waste that should be reported in block B.

- All other waste from the establishment, including waste from canteen and administration, and waste that is delivered for re-use or recycling externally.
- Note that packaging shall be included in industrial waste.

Chemicals, box 021, refers to chemicals that are not hazardous waste, e.g. sugar, sodium chloride, calcium, commercial fertilizer.

If the waste from the establishment contains other components than those included in the list, these components shall be specified under *Other, specify*, and the quantity reported in box 023. If the waste is mixed and it is impossible to estimate the quantity of the different components, the quantity shall be reported under *Mixed, unknown*, box 024.

The waste shall be distributed according to whether it originated from *new building, rehabilitation* or *demolition*.

C. Quantities of hazardous waste from own activities

This block is to be used to report the quantities of hazardous waste generated at the establishment. (See definitions).

The term *pesticides* includes fungicides, insecticides and other pest-killing agents.

If the establishment has hazardous waste that cannot be placed in one or other of the listed categories, the content of this waste shall be specified under *Other, specify*, and the quantity shall be reported in boxes 045 to 048.

If the hazardous waste is mixed and it is impossible to estimate the quantities of the different categories, the quantity shall be reported under *Mixed, unknown*, box 049.

NB! The quantity of hazardous waste shall be reported in kilograms.

D. Disposal of industrial waste from own activities (Including waste packaging)

In this block, the waste shall be distributed according to how it was disposed of: whether it was recycled, burned, treated biologically, deposited on a landfill or disposed of in some other way. You are asked to distinguish between waste that was treated at an external facility and waste that is managed on your own premises/treated in your own plant.

Waste that is used for recycling of materials or is used again (re-use) shall be reported only if the waste in question is delivered to an external facility/enterprise (cf. B).

If waste from the establishment is stored temporarily or disposed of in other ways, the quantity of this waste should be reported under *Other, specify*, box 080 (external facility) and/or box 090 (own premises/treatment plant). Specify how this waste is disposed of.

The number of tonnes of industrial waste reported in box 091 shall be equal to the number of tonnes of industrial waste reported in box 025.

E. Disposal of hazardous waste from own activities

The hazardous waste shall be reported under the same categories as in block C. State the name of the recipient or transport company that has dealt with the waste. Under *Managed on own premises*, you should state the method of disposal employed. If the establishment has temporarily stored some of the hazardous waste that was generated in 1993, then the quantity stored should be reported under *Managed on own premises*. The number of kilograms of hazardous waste reported in box 122 should be equal to amounts reported in box 050.

F. Quantities of waste packaging from own activities (Specified data)

This block is for reporting the share of the waste that is/has been packaging. Thus the quantity of waste packaging is part of the quantity of industrial waste reported in block B. If the waste packaging consisted of components other than those listed under F in the questionnaire, this shall be specified under *Other, specify*, box 130. If the waste packaging was mixed and it is impossible to estimate the quantity of the different components, the total quantity shall be reported under *Mixed, unknown*, box 131.

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