Statistics Norway
Department of Economic Statistics

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Documents

Statistics on Waste and Recycling from Parts of the Public Sector

Contents

STATISTICS ON WASTE FROM THE PUBLIC SECTOR

A survey conducted in 1995 covering the Municipal engineering sector, Central government administration in relation to health and other social services, Vocational schools for agriculture, Universities and colleges, Research and scientific institutes, Health and veterinary services plus Old people's social services.

1. INTRODUCTION

In 1991 the Norwegian Pollution Control Authority (Statens Forurensningstilsyn - hereinafter "SFT") presented a proposal for future waste statistics (SFT 1991). In Report No. 44 (1991-92) to the Storting (the Norwegian parliament) on Action for Minimisation, Increased 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 (hereinafter "SN") was given the primary responsibility for further development of national waste statistics.

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

- ** Satisfy the Ministry of the Environment's and SFT's need for data reporting in connection with the evaluation of the results of the different measures (outcome assessment).
- ** Satisfy requirements for a data basis for central and local government planning and administration.
- ** Provide a basis for study of alternative forms of treatment, of a waste minimisation and recycling programme, and of general environmental issues.
- ** Meet international requirements regarding classification of data and data collection methodology.
- ** Provide information to industry, educational institutions, interest-groups, the media and private citizens.

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 industrial waste proceeded in parallel with a comprehensive survey of municipal waste. A pilot study was conducted in Spring 1993 among a sample of establishments from a selection of industries and municipalities (SN 1993b), which was followed in Spring 1994 by a sample survey on oil extraction, quarrying and mining, manufacturing industry and construction (SN 1995a). This pilot survey on parts of the public sector is a continuation of that work.

2. DEFINITIONS

The statistical unit of the survey is the individual establishment in which the waste is generated (also called *the source*). An *establishment* is defined by SN's Establishment Register as *a locally*

delimited, functional entity in which activities are conducted that mainly fall within a given industry group. By *industry group* we mean a collection of economic activities that are as homogeneous as possible with regard to the technical organisation of the production of goods and services and with regard to the nature and application of those goods and services. *Industry 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 industry division	1-digit code
Industry division	2-digit code
Major industry group	3-digit code
Industry group	4-digit code
Industry sub-group	5-digit code (National Norwegian level)

Waste is defined in accordance with Section 27 of the (Norwegian) Pollution Control Act:

> "Waste means discarded objects or substances. Waste also includes superfluous objects from service activities, production and treatment plants etc. Wastewater 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 activity.
>
> *Production waste* means waste from industrial activity and service activities which in type and quantity is significantly different from consumer waste.
>
> *Special (or hazardous) waste* means waste which cannot be appropriately treated together with consumer waste because of its size or because it may lead to serious pollution or risk of injury to persons or animals."

Our waste classification is primarily by economic activity. For example all waste (consumer, production, and hazardous waste) that was generated by industry groups 9316 + 9318 + 9320 was classified as waste from education.

Our further classification of the waste rests on a materials-based classification that takes account of the materials' potential for recycling and re-use (see page 6). Materials reused or recycled on own premises are not included in the waste quantities.

3. CONVERSION FACTORS

The experience obtained from the surveys on municipal waste, from visits to establishments and from the pilot survey brought to light a need to use specific factors to convert the figures from quantities (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 a local waste management company, Søndre Vestfold Avfallsselskap. The total net weight of a specific load was divided by the total volume of the containers. The degree to which the containers were full or not was disregarded.

The factors that were used: m^3 x factor:

		Factor
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 (*)
15.	Paint, glue, varnish	1.2 (*)

4. DATA COLLECTION METHODS

In the light of the experience obtained from earlier surveys, this time we chose to try questionnaires circulated and returned by post. Even though last year's survey yielded very good results using municipal employees as interviewers, that method is more expensive than postal surveys. We wished to investigate whether this is correct in relation to a detailed audit with good telephone follow-up - as we planned for this survey.

The data were collected under the statutory authority of the *Act No. 54 of 16 June 1989 pertaining 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 waste catalogue, the UN/ECE's waste classification, the SFT's long-term plan and interviews with persons responsible for waste management in establishments and institutions. A preliminary draft of the questionnaire was tested by visiting hospitals, medical centres, dental surgeries and municipal engineering departments.

The main points in the questionnaire are:

1. Identification: establishment number, ISIC number, name
2. Quantity of industrial waste generated per year classified by 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 complete 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:

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

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), with the addition of radioactive waste, asbestos and infectious waste:

Waste oil, lubricating oil	Oily waste from separators	Oil emulsions
Halogenated solvents	Non-halogenated solvents	Paint, glue and varnish
Distillation residues and tar waste	Heavy metals/batteries	Waste containing cyanide
Discarded pesticides	Isocyanates	Other organic waste
Strong acids	Strong alkalis	Other inorganic waste
Waste containing PCB	Photographic chemicals	Radioactive waste
Asbestos	Infectious waste	Pathological waste
Other		

Management of the waste

The management of waste from own activities was divided between treatment at external waste treatment facilities or management at the establishment's own facilities. Relevant methods of management were:

** Recycling or re-use of materials
** Incineration with or without utilization of energy
** Sorting
** Biological treatment

** Deposition on landfills
** Use as fill material
** Discharge into the sewer system
** Other

Packaging

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

The EU started to plan a legal document for reporting of packaging quantities in 1993/94. It was therefore important to get to know packaging quantities and categories in advance of any possible mandatory report to the EU. (Subsequently the Norwegian environmental authorities were mandated by the EU's Council Directive 94/62/EC to report annual quantities of packaging waste each year. The first report will probably be made in 1998.)

6. THE SAMPLE

6.1. Industry divisions

Eurostat has proposed a Council Regulation on statistical information about waste quantities and management. In accordance with this proposal, waste quantities from all economic activities and private households are to be reported every third year, classified by the different materials. Establishments engaged in recycling and sewage and refuse disposal are to report each year. It is important that we learn as much as possible about the economic activities before we start on the work of the first report. In 1994 we obtained good information about waste in the following industries:

ISIC	1993	Division
2	Oil extraction, mining and quarrying	
	22	Extraction of crude oil and natural gas
	23	Metal ore mining
	29	Other mining
3	Manufacturing	
	31	Manufacture of foods, beverages and tobacco products
	32	Manufacture of textiles, wearing apparel, leather and leather products
	33	Manufacture of wood and wood products, including furniture
	34	Manufacture of paper and paper products, printing and publishing
	35	Manufacture of chemicals and of chemical petroleum, coal, rubber and plastic products
	36	Manufacture of mineral products
	37	Manufacture of basic metals
	38	Manufacture of fabricated metal products, machinery and equipment
	39	Other manufacturing industries
5	Construction	

There were many industries left to choose from when a new pilot survey was to be planned, but due to limited resources we had to delimit and assign strict priorities. Public administration is a large sector with a large workforce and a high level of resource use. The health services above all could generate a lot of waste, particularly a lot of hazardous waste. There has also been some media attention paid to waste management in hospitals (for example when pathological waste is found to have been simply thrown on landfills). We wished to know the quantities of this kind of waste, and also to find out what kind of overview the hospitals have regarding their own waste. In consultation with SFT we chose to emphasise hospitals/the health sector in the pilot survey. We included higher education and research plus the municipal engineering sector. For the municipal engineering sector it was of particular interest to see whether it was possible to separate their own activities from the services they provide to the population of their municipality. (Is it, for example, possible to separate the waste generated by the operation of waste disposal sites from all the waste which ends up there from households, trade and industry?) For the education and research sector we wanted an overview of waste production, including paper waste, plastic waste, electronic waste and, above all, laboratory waste.

This time around, the Armed Forces - which are an important part of the public sector - were excluded for resource reasons. Similarly, we excluded commerce, offices, service industries and the transport sector, because they are strongly dominated by small businesses, and therefore cause a methodological problem requiring great resources. They are also a policy problem. Moreover, most of the waste from here is probably included in municipal waste and consists mainly of paper. The system of payments for delivery of old cars to the crushers (the "wreck deposit") also gives us a good view of the vehicles leaving the car fleet. Primary industry was excluded this time, too, because of methodological problems which demand a lot of resources to solve.

An important aspect of this pilot survey was to test out the sampling methodology. It has long been maintained that SN`s Establishment Register is poorly updated on the public sector. If we cannot use the register as the basis of future reports, we will have to find alternative solutions with a view to reports to the EU.

On this basis we made a sample of the following industries:

ISIC	Division
911	Municipal engineering
9124	Central government administration in connection with health and other social services
9316	Vocational schools for agriculture
9318	Universities and colleges
932	Research and scientific institutions
933	Medical, dental, other health and veterinary services
93421	Homes for the aged

Municipal engineering embraces all activities conducted or supervised by the municipal engineering departments. This includes offices/administration under the Director of Engineering Services, workshop for maintenance work on own vehicles and equipment, operation of water/sewage treatment plants and waste disposal plants, operation of the park service, maintenance/snow clearance/gritting/salting etc. of roads and open spaces, construction/reconstruction/ renovation/demolition of buildings, any caretaker functions, plus the fire departments.

6.2. Size of establishment and classification by size

It is an international desideratum to find coefficients for calculation of waste quantities. The 1994 survey attempted to find a connection between waste quantities and the size of establishments. A distinct correlation of the total figures appeared, but it was not possible to calculate an unambiguous coefficient with a view to e.g. the number of employees. Since we did not know of any better alternative, we elected to continue this line of thought in this survey too, and 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. Sampling plan and selection

6.3.1. Population and basis for selection

The SN`s Establishment Register as of March 1995 was used as a selection basis. The variables taken from the Establishment Register were establishment number, industry division, man-years, type of establishment and municipality number.

The population for municipal engineering = total number of municipalities in the country = 435.
The population for the other divisions appears in Table 2, a total of 9162 establishments/units.

6.3.2. Sampling method

The sampling plan emphasised the need to obtain good total figures. It was thus important to include establishments that contributed large quantities of waste. It is reasonable to assume that the quantity of waste will often be positively correlated with the number of employees, especially for homogeneous units in the public sector. We used the number of man-years as a measure of establishment size. Large establishments were selected with probability equal to 1, while the rest of the sample was systematically graded by size and municipality. The selection of the municipal engineering sector was made separately from the rest of the sample.

6.3.2.1. Sampling the *Municipal engineering sector*
We assumed that there is a correlation between the size of municipality, the size of its engineering sector and its waste quantity. It was therefore important to include the largest municipalities. The 435 municipalities were first sorted by population and then the 10 largest municipalities were sampled. The population in these municipalities represents 35 per cent of the Norwegian population.

Afterwards the 425 remaining municipalities were sorted by municipality number. From the 11 first municipalities on the list we picked out one at random, followed by every 11th municipality down the list. In this way 39 municipalities were selected. The last municipality was picked at random from the complete list. The population in these 40 municipalities represents 10 per cent of the

country's population. The final sample for the *municipal engineering sector*, a total of 50 establishments/units (= municipalities), is shown in Table 1.

Table 1. Sample of municipal engineering sector.

Municipality no.	Municipality	Municipality no.	Municipality
0106	Fredrikstad	1201	Bergen
0121	Rømskog	1214	Ølen
0211	Vestby	1233	Ulvik
0219	Bærum	1251	Vaksdal
0220	Asker	1411	Gulen
0229	Enebakk	1426	Luster
0301	Oslo	1444	Hornindal
0403	Hamar	1519	Volda
0428	Trysil	1535	Vestnes
0502	Gjøvik	1560	Tingvoll
0522	Gausdal	1601	Trondheim
0543	Vestre Slidre	1620	Frøya
0602	Drammen	1638	Orkdal
0620	Hol	1703	Namsos
0633	Nore og Uvdal	1736	Snåsa
0719	Andebu	1755	Leka
0806	Skien	1824	Vefsn
0819	Nome	1838	Gildeskål
0901	Risør	1853	Evenes
0937	Evje og Hornindal	1871	Andøy
1001	Kristiansand	1902	Tromsø
1026	Åseral	1924	Målselv
1103	Stavanger	1940	Kåfjord
1112	Lund	2017	Kvalsund
1134	Suldal	2030	Sør-Varanger

6.3.2.2. Sampling the industry divisions of *Central government administration health/social services, Vocational schools for agriculture, Universities and colleges, Research and scientific institutes, Health and veterinary services* and *Homes for the aged.*

The samples were taken on the basis of SN`s Establishment Register as of March 1995 (called the *Sampling Basis*).

The sample plan contains three parts:

A: First a total count was made for some major industry divisions (ISIC83 93161, 93162, 93163, 93181, 93185, 93336, 93352 and 93353). For two of the divisions (93181 and 93185), however, 5 (out of 22 units) and 3 (out of 5 units) respectively were deleted after the selection in order to reduce the sample. A total of 62 establishments were selected in Sub-sample A.

B: Afterwards a total of 100 of the largest establishments in the remaining divisions were selected. This does not apply to Divisions 93361, 93362, 93363, 93371, 93379 and 93421, since the Establishment Register lacked employment figures for these.

C: Finally, 138 establishments from the remainder of the population were selected. For the divisions whose employment figures could be found in the Establishment Register, the establishments were sorted by employment and municipality number. A systematic selection was made so that we also made sure that the establishments were dispersed among the municipalities. For the remaining industry divisions that lacked employment figures, the establishments were sorted by municipality number, and the establishments systematically selected.

The number of establishments selected in each division was proportional to the number of establishments in the population (excluding those selected as a complete count). For the divisions for which we lack the employment figures, we first selected a number comparable with the number of large establishments in the industry divisions for which we had employment figures and thereafter selected proportionately with the number of establishments in the industry divisions.

The result of the sampling is reproduced in Table 2. Table 3 summarises the results by the 4-digit ISIC83 level, since publication of the figures is not to be at greater detail than this. What is called the *Questionnaire Sample* is the number of establishments, 300 (+50 from the municipal engineering sector), who received a questionnaire in Week 23 (c.f. Section 7.1 below.).

Table 2. Overview of the Sampling basis and the Questionnaire Sample at a 5-digit ISIC83 level. Number of establishments.

Industry division		Sampling basis	Questionnaire Sample			
			A	B	C	Total
91240	Central govt.admin., health/social	529	-	10	6	16
93161	Agricultural schools	2	2	-	-	2
93162	Horticulural schools	3	3	-	-	3
93163	Forestry schools	4	4	-	-	4
93181	Universities	22	17	-	-	17
93182	District colleges	20	-	2	-	2
93183	Colleges of education	32	-	2	-	2
93184	Colleges of engineering	32	-	2	-	2
93185	Colleges of social studies	5	2	-	-	2
93186	Colleges of health education	48	-	2	-	2
93187	Military colleges	16	-	2	-	2
93189	Other colleges of higher learning	78	-	2	-	2
93200	Research and scientific institutes	270	-	10	3	13
93332	Diagnostic and other lab.services.	48	-	2	1	3
93333	General practitioners	1 781	-	10	19	29
93334	Specialized practitioners	446	-	5	5	10
93336	Nursing and midwifery	7	7	-	-	7
93341	Dentists' services	1 854	-	10	21	31
93342	Dental mechanics	198	-	5	2	7
93351	Somatic hospitals	117	-	10	1	11

93352	Specialized somatic hospitals	16	16	-	-	16
93353	Cottage hospitals and maternity homes	11	11	-	-	11
93354	General somatic homes	526	-	5	6	11
93355	Combined nursing homes and homes for the aged	526	-	5	6	11
93356	Specialized somatic nursing homes	41	-	2	-	2
93357	Rehabilitation	72	-	2	1	3
93359	Other somatic health institutions	15	-	2	-	2
93361	Mental hospitals	97	-	-	11	11
93362	Psychiatric institutions for children and adolescents	123	-	-	6	6
93363	Nursing homes for mentally diseased	126	-	-	7	7
93371	Main institutions for the mentally retarded	22	-	-	2	2
93379	Other health institutions for the mentally retarded	352	-	-	12	12
93390	Veterinary services	1265	-	10	14	24
93421	Homes for the aged	458	-	-	15	15
Total		9 162	62	100	138	300

Table 3. Overview of the Sampling basis and the Questionnaire Sample at a 4-digit ISIC83 level. Number of establishments.

Industry division		Sampling basis	Questionnaire Sample			
			A	B	C	Total
9124	Central govt. admin., health/social	529	-	10	6	16
9316	Vocational schools for agriculture	9	9	-	-	9
9318	Universities and colleges	253	19	12	-	31
9320	Research and scientific institutes	270	-	10	3	13
9333	Health services	2 282	7	17	25	49
9334	Dental health services	2 052	-	15	23	38
9335	Somatic health institutions	1 324	27	26	14	67
9336	Psychiatric health institutions	346	-	-	24	24
9337	Health institions for mentally retarded	374	-	-	14	14
9339	Veterinary services	1 265	-	10	14	24
9342	Homes for the aged	458	-	-	15	15
Total		9 162	62	100	138	300

6.3.3. Calculation of weighting

6.3.3.1. Weighting of the *Municipal engineering sector*

To calculate national figures we chose to post-stratify (for the reasons for this, see Section 6.3.3.2.). For the municipal engineering sector we used the number of inhabitants as an explanatory variable. The weight for the 10 largest municipalities was found by:

$$\frac{\text{total number of inhabitants in the 10 largest municipalities}}{\text{total number of inhabitants in the 8 municipalities which replied}} = 1.27$$

For the 40 remaining, randomly selected municipal engineering sectors, the weight was found by:

$$\frac{\text{total Norwegian population - total number of inhabitants in the 10 largest municipalities}}{\text{total number of inhabitants of the (40-7=33) municipalities which replied}} = 15.39$$

6.3.3.2. Weighting of the industry divisions of *Central government administration health/social services, Vocational schools for agriculture, Universities and colleges, Research and scientific institutes, Health and veterinary services* and *Homes for the aged.*

Correction of deleted establishments

To calculate national figures we chose to post-stratify. One of the reasons for this was that a total of 21 questionnaires (7 per cent) were returned because the establishment had moved, was not known to the post office, had closed, reorganised or was downright miscoded in the Establishment Register (these are the *deleted establishments* in Tables 5, 7 and 8). For example, (plant) nurseries were entered in the Establishment Register under vocational schools for agriculture, and included in our sample as such. When these were deleted we were left with a sample of 3 activities in this group. It seems improbable that the whole statistical population here should consist of just four schools (c.f. table 4).

Because of the recent "Care in the Community" reform (the "HVPU Reform"), many of the institutions for care of the mentally retarded in our sample had closed or had been reorganised, so that the users had become part-owners and come in under private households.

The Establishment Register was not up to date with regard to the recent educational reform either. Many of the colleges in our sample had changed their names and/or field of operations. Many units had been amalgamated into new and larger colleges. Some were deleted because we did not manage to track them down, or because they no longer fitted our sample.

The basis for calculating weightings through post-stratification was therefore a new, more up-to-date transcript of the Establishment Register (November 1995, hereinafter called the *Establishment Register Population*), given in the left-hand column of Table 4. The right-hand column contains a correction of the sampling basis (Tables 2 and 3) which we call the *Statistical Population.* This has been obtained by taking the Questionnaire Sample from Table 3 (and the Establishment Register Population), removing the establishments that have been deleted on grounds of moving, unknown, closing, reorganisation or miscoding, and adding the establishments in the sample that either belonged to the deletions or among those who replied but which were no longer included in the updated November transcript - that is, in the Establishment Register Population. This had little overall significance, but for universities and colleges it meant an increase of 10 per cent.

Table 4. Establishment Register Population (updated transcript in November 1995) and Statistical Population, by industry division. Number of establishments.

Industry division		Establishment register population (Nov.95)	Statistical population (corrected sampling basis)
9124	Central govt. admin., health/social	529	529
9316	Vocational schools for agriculture	9	4
9318	Universities and colleges	266	276
9320	Research and scientific institutes	282	282
9333	Health services	2 302	2 299
9334	Dental health services	2 193	2 193
9335	Somatic health institutions	1 326	1 327
9336	Psychiatric health institutions	344	347
9337	Health institions for mentally retarded	334	332
9339	Veterinary services	1 306	1 306
9342	Homes for the aged	460	460
Total		9 351	9 355

Tables 5, 6, 7 and 8 are overviews of deleted establishments, failures to reply, reply sample and Establishment Register Population for the 162 establishments in Sub-samples A and B and the 138 establishments in part C. Failure to reply means the establishments which could have replied but which for reasons unknown did not do so. Those replying we have called the *Reply Sample.*

Table 5. Establishments deleted because they had moved, were unknown, closed, reorganised or miscoded, by industry division. Number of establishments.

Industry division		Total
9124	Central govt. admin., health/social	0
9316	Vocational schools for agriculture	6
9318	Universities and colleges	2
9320	Research and scientific institutes	1
9333	Health services	3
9334	Dental health services	2
9335	Somatic health institutions	2
9336	Psychiatric health institutions	0
9337	Health institions for mentally retarded	5
9339	Veterinary services	0
9342	Homes for the aged	0
Total		21

Table 6. Failure to reply, by industry division. Number of establishments.

Industry division		Total
9124	Central govt. admin., health/social	2
9316	Vocational schools for agriculture	0
9318	Universities and colleges	6
9320	Research and scientific institutes	0
9333	Health services	8
9334	Dental health services	4
9335	Somatic health institutions	6
9336	Psychiatric health institutions	2
9337	Health institions for mentally retarded	0
9339	Veterinary services	1
9342	Homes for the aged	2
Total		31

Table 7. Failure to reply, deleted establishments, and Reply Sample for Sub-samples A and B. Number of establishments which were Outside the Establishment Register Population, compared to the Establishment Register Population.

	Outside the Establishment register population	The Establishment register population (Nov. 25)	Total
Failed to reply	2	15	17
Deleted	2	11	13
Reply Sample	14	118	132
Total	18	144	162

Table 8. Failure to reply, deleted establishments, and Reply Sample for Sub-sample C. Number of establishments which were Outside the Establishment Register Population, compared to the Establishment Register Population.

	Outside the Establishment register population	The Establishment register population (Nov. 25)	Total
Failed to reply	1	13	14
Deleted	2	6	8
Reply Sample	4	112	116
Total	7	131	138

The sum of Tables 7 and 8 (162+138=300) is identical to the sampling basis (Tables 2 and 3). The sum of the Reply Sample in Tables 7 and 8 (132+116=248) gives the Reply Sample for the survey (additional to the Reply Sample for the municipal engineering sector: 248+41=289) (Table 11).

Weighting

In our calculation of national figures, we had 132 establishments in the Reply Sample for Sub-samples A and B, which were used to calculate figures for 149 establishments in the Statistical Population, since the 13 deletions had been removed from the sampling basis of 162 (Tables 7 and 9).

Table 9. Weighting of the establishments of Sub-samples A and B.

Industry division		Reply sample	Statistical population	Weight
9124	Central govt. admin., health/social	8	10	1,25000
9316	Vocational schools for agriculture	3	3	1,00000
9318	Universities and colleges	23	29	1,26087
9320	Research and scientific institutes	9	9	1,00000
9333	Health services	19	22	1,15789
9334	Dental health services	14	15	1,07143
9335	Somatic health institutions	46	51	1,10870
9339	Veterinary services	10	10	1,00000
Total		132	149	

The weighting of establishments of Sub-sample C was calculated on the basis of a Statistical Population of in all 9206 establishments (9355-149=9206) (Table 10).

Table 10. Weighting for the establishments in Sub-sample C.

Industry division		Reply sample	Statistical population	Weight
9124	Central govt. admin., health/social	6	519	86,500
9316	Vocational schools for agriculture	-	1	-
9318	Universities and colleges	-	247	-
9320	Research and scientific institutes	3	273	91,000
9333	Health services	19	2277	119,842
9334	Dental health services	18	2178	121,000
9335	Somatic health institutions	13	1276	98,154
9336	Psychiatric health institutions	22	347	15,773
9337	Health institions for mentally retarded	9	332	36,889
9339	Veterinary services	13	1296	99,692
9342	Homes for the aged	13	460	35,385
Total		116	9206	

The one establishment in industry division 9316 and the 247 establishments in division 9318 (Table 10) have no establishments in the Reply Sample. For these two divisions, therefore, we do not have a full coverage for the whole division, only for the establishments in Sub-samples A and B.

6.3.4. Final Reply Sample

The final Reply Sample is shown in Table 11. The sample's Statistical Population covers about 16 per cent of all the establishments in public and private services.

Table 11. Reply sample sorted by industry division, including the municipal engineering sector. Number of establishments.

Industry division		Total
911	Municipal engineering	41
9124	Central govt. admin., health/social	14
9316	Vocational schools for agriculture	3
9318	Universities and colleges	23
9320	Research and scientific institutes	12
9333	Health services	38
9334	Dental health services	32
9335	Somatic health institutions	59
9336	Psychiatric health institutions	22
9337	Health institions for mentally retarded	9
9339	Veterinary services	23
9342	Homes for the aged	13
Total		289

7. IMPLEMENTATION

7.1. Mailing of the questionnaire

All the questionnaires were mailed in Week 23, with a request to respond by 30th June. The questionnaire was accompanied by a letter signed by the Director General of Statistics Norway. No return envelope was supplied.

7.2. Mailing of reminders

Four weeks after the expired deadline(24th July) a reminder letter was mailed to the establishments which had not yet returned the questionnaire. A total of 183 establishments were given a new deadline, 4th August. Two weeks after expiration of this deadline (24th August) a second reminder was posted to 117 establishments, with a final deadline of 1st September. In this letter we wrote that we would consider the imposition of fines if they did not reply before the deadline.

No further reminders were sent, and it was decided not to exercise the right to impose a fine. The reason for this was the same as for the 1994 survey (Memorandum of 13th June 1994 on use of fines, see Appendix).

7.3. Auditing and registration of the data

The audit took the form of a thorough review of all the returned questionnaires. One auditor worked on this task full-time. 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 concerned the quantities of acids and alkalis, some of which were given 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 the rubric of *Hazardous waste, managed on own premises.*

Hazardous waste delivered together with production and consumption waste to waste disposal sites is registered under the rubric of *Hazardous waste, delivered to approved external treatment facility* and includes all the water.

Some solvents used for cleaning were given in purchased quantities. In cases where we assumed that the active constituents had either evaporated or entered the sewage system with the rinsewater, the solvents were not included in the waste quantities.

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

Pathological waste, cytostatica and high-risk waste (hypodermic needles etc.) were recorded on a common postal code under *Other* (hazardous waste). Where this went for incineration in own facilities and the ash was delivered to a waste disposal site, the quantity of ash was entered under *Deposited on landfill* and the waste quantity before incineration under *Managed on own premises* (hazardous waste).

If the supplier of the data did not know who had dealt with the waste, the quantity is entered under *Other, specify.*

Chemicals and other dilutable waste other than hazardous waste which was flushed down the sewer system is entered under *Managed on own premises.* If sludge was fetched by a tanker and driven to a purification plant, the quantity is entered under *Treated at an external facility, other.*

Paper waste from nursing homes proved to consist of large quantities of nappies (diapers). During the auditing these institutions were telephoned, and the nappies/diapers were separated out into an item on their own.

The organisation of the municipal engineering sector was found to vary as regards fields of activity. Wherever possible we attempted to include waste from operation of roads, water, sewage, rubbish collection, fire services, building and zoning and technical services. During the audit we had to constantly check that the waste came from operation of the engineering department and not waste quantities collected from the inhabitants of the municipality (this means, for example, that sludge from municipal sewage treatment plants is not included).

Problems also arose with the definition of "external facilities" contra what was dealt with in the engineering department's own facilities.

We chose this classification:

** *Treated at an external facility*
  - Delivered to a public waste disposal site
  - Approved waste disposal site, also used by others
  - Municipal areas that are used by private persons or other municipal departments.

** *Managed on own premises*
  - Areas that only are used by the municipality or that they are responsible for, for example road verges or parks.

The waste quantities from the municipal engineering sector consisted of large quantities of sweepings from spring-cleaning and excavation masses in the form of soil, rock and gravel. This is recorded under *Mineral waste.* Asphalt temporarily stored for subsequent reuse is recorded under *Treated at an external facility; other, specify.* Asphalt for own recycling is not included. Garbage picked up at public disposal facilities is included. Where the municipal engineering department operates caretaker services in nursing homes, schools etc., and deals with waste from operation of municipal engineering and building waste, the waste is included. Other ordinary waste from the institutions is not recorded under the municipal engineering department.

7.4. Organisation of the data

An improved punching program as compared with the 1994 survey in QBE Vision was created for this survey. The database was Oracle 7. The data input was undertaken by one of the auditors.

8. DISCUSSION OF QUESTIONNAIRE RETURN AND PROCESSING

8.1. Non-reply and response rate

146 questionnaires were returned after the deadline. The reminder that was sent to 183 establishments 4 weeks after the deadline resulted in 61 replies. After the second reminder we received 82 new questionnaires. That means that 49 per cent of the respondents replied after the reminders. The failure-to-reply figure is therefore 40 establishments (12 per cent calculated by the Questionnaire Sample *minus* the establishments failing to reply: 350-21=329).

The failure to reply figure comprises the establishments that we never heard from, that is, those which could have replied but did not do so. The respondents we called the Reply Sample. The Reply Sample, sorted the way we have chosen to present the results in connection with the returned questionnaires and completion of the questionnaire, is shown in Table 12.

Table 12. The Reply Sample. Number of establishments.

Industry division		Total
911	Municipal engineering	41
9124	Central govt. admin., health/social	14
9316	Vocational schools for agriculture	3
9318	Universities and colleges	23
932	Research and scientific institutes	12
933	Health and veterinary services	183
93421	Homes for the aged	13
Total		289

Our general impression was that the central government administration was least willing to complete the questionnaire. They showed little understanding that this was one of their responsibilities. We were even asked whether the questionnaire had been sent to them just "for information". Some small establishments enquired if small waste quantities were of interest and asked "how do we complete the form when we have less than a ton of waste?". Many of them considered that we should get in touch with the waste disposal company, and had little understanding that they themselves ought to know something about their own waste.

There were also problems getting the questionnaires returned from some municipalities (the engineering departments), but the reason here was, in contrast, that the registration involved a lot of work and that it was difficult to obtain figures from the different activities.

8.2. Sampling method

Sampling by establishment number often resulted in considerable demarcation problems, particularly for the medical officers of health, the office of the directors of health and social services, public veterinary services and public dental health services. Either these services were dispersed between

many different addresses around the district, or else many different services were gathered under one roof. It was often difficult for them to separate the waste from a single establishment (or several of them), as we wished. We chose to restrict the survey to the part of the activity that took place at the physical address to which the questionnaire was sent.

Reorganisation also caused major problems; particularly in the health/social services sector, a lot has happened in recent years because of the "Care in the Community" reform for the mentally retarded (the HVPU Reform). Residential accommodation for old people, young people and criminals, former institutions for the mentally retarded and so forth have now become sheltered accommodation for the mentally retarded living "in the community". The accommodation unit will therefore belong to a different ISIC industry division, and in some cases to private owners. In such cases we registered any incoming forms but not the waste quantities. Some of the non-reply rate is to be found here, but it is probable that we have not discovered all such changes and have therefore included such units in some places but not in others.

Some doctors, dentists, veterinary surgeons and special hospital units were double-registered (registered as public and private activity at the same time) in the Establishment Register. When we realised this, we used the figures from the questionnaires that were completed best. The other questionnaire was registered as returned, and the waste quantities were not entered.

Municipal reorganisation also created problems; most municipalities have abolished engineering services as a separate department, and the old functions are now spread around the whole administration. This caused demarcation problems here too. The municipalities have clearly included different entities even though we endeavoured to do the demarcation between the various activities for them. We do not know who has included what. In some cases it was clear that the municipalities had included municipal waste too. This was easy to spot, however, and was "weeded out" during the auditing.

There are, therefore, obvious sources of error here, and these factors (demarcation, identification and reorganisation) were the biggest problems we faced in the survey.

Our attempt to group the companies by size had to be abandoned. The reason was twofold:

** Very many establishments were registered with zero employees in the SN`s Establishment Register.
** There were big differences between the number of employees as stated by the supplier of the data and the number stated in the Establishment Register. Because many omitted to answer the question as to how many employees they had, there were a lot of zeros in this field.

8.3. Auditing

8.3.1. Time spent on auditing

The auditing took longer than we expected. All the establishments showed a will to co-operate and were glad to receive help and discuss problems connected with the generation and management of waste. A lot of the information was amended through the telephone calls. In one particular case the

waste quantity "increased" by an average of 10 tonnes per minute as the call progressed, from 100 tonnes to 500 tonnes during a 40-minute review of the establishment's management of its waste.

The quality of the replies is reflected in the time spent on auditing. Of the establishments that returned the questionnaires, 177 (61 per cent) had to be contacted by telephone, (4 establishments stated that they did not have any waste, neither production, consumer waste nor hazardous waste) (Table 13). A total of about 103 hours was spent on auditing the questionnaires.

Table 13. Number of establishments contacted by telephone during the auditing.

Industry division		Phoned	
		Number	Per cent
911	Municipal engineering	25	61
9124	Central govt. admin., health/social	5	36
9316	Vocational schools for agriculture	2	67
9318	Universities and colleges	10	43
932	Research and scientific institutes	5	42
933	Health and veterinary services	120	66
93421	Homes for the aged	10	77
Total		177	61

8.3.2. Completion and comprehension of the questionnaire

In general, the questionnaire functioned well. However, in many cases the responses were incomplete because the establishments did not know enough about what waste they actually generated, and therefore entered all the waste in the box for mixed waste (Table 14). Many of them had not entered names of the recipient for production and consumer waste. Establishments with premises in large leased office complexes have little to do with their waste; the waste disposal is included in their contracts of lease as part of the caretaker service, and the tenants do not, therefore, know what happens to it.

Some questionnaires from municipal engineering services were completed giving total waste quantities from the whole municipality. The reason may be that the municipalities had reported such quantities previously. This should, perhaps, have been better specified in the questionnaire for the municipal engineering sector.

Table 14. Establishments that had entered all the production and consumer waste under *Mixed waste* before auditing, and number of questionnaires with *Mixed waste* specified during the auditing.

Industry division		Number	Per cent of Reply Sample	Number of questionnaires specified during the audit*
911	Municipal engineering	18	44	0
9124	Central govt. admin., health/social	5	36	0
9316	Vocational schools for agriculture	2	67	0
9318	Universities and colleges	12	52	0
932	Research and scientific institutes	6	50	0
933	Health and veterinary services	69	37	21
93421	Homes for the aged	6	60	1
Total		118	41	22

* By and large questionnaires from nursing homes that could estimate per centage of nappies/diapers entered under *Mixed waste.*

A total of 75 establishments stated that they did not have hazardous waste (tables 15 and 17).

Table 15. Establishments that stated that they had generated hazardous waste. Before auditing.

Industry division		Number	Per cent of Reply Sample
911	Municipal engineering	40	98
9124	Central govt. admin., health/social	3	21
9316	Vocational schools for agriculture	2	66
9318	Universities and colleges	14	61
932	Research and scientific institutes	9	75
933	Health and veterinary services	136	75
93421	Homes for the aged	9	69
Total		213	74

Many of the establishments had either not completed Field C, *Disposal of production and consumer waste from own activities*, or had recorded all the waste in the box for *Deposited on landfill* (Table 16)(13 establishments stated that they did not generate any production/consumer waste). As a rule, the waste was collected by a transport company, who "did whatever they wanted" with it.

Table 16. Establishments that completed field C, *Disposal of production and consumer waste from own activities* satisfactorily and in conformity with information from the waste collection company and/or the municipality. Before auditing.

Industry division		Number	Per cent of Reply Sample
911	Municipal engineering	41	100
9124	Central govt. admin., health/social	10	71
9316	Vocational schools for agriculture	1	33
9318	Universities and colleges	14	61
932	Research and scientific institutes	5	42
933	Health and veterinary services	129	71
93421	Homes for the aged	4	31
Total		204	71

Table 17. Establishments that had completed field D, *Disposal of hazardous waste from own activities* satisfactorily. Before auditing.

Industry division		Per cent of those who reported hazardous waste	Per cent of all*
911	Municipal engineering	53	54
9124	Central govt. admin., health/social	33	86
9316	Vocational schools for agriculture	50	67
9318	Universities and colleges	43	65
932	Research and scientific institutes	22	25
933	Health and veterinary services	36	51
93421	Homes for the aged	22	46
Total		39	31

* Including those who did not answer

47 per cent of the establishments failed to specify how much of the waste consisted of packaging (Table 18). None of them had misunderstood that the quantities in Field E, *Quantities of waste packaging* were also included in Field A, *Quantity of production and consumer waste from own activities.* Many of them knew the quantity of cardboard and carton that were delivered for recycling, and entered the same figures as waste packaging generated. It is still probable that *Mixed, unknown waste* contains a lot of packaging not given as waste packaging.

Table 18. Establishments that had specified packaging, Field E. *Quantity of waste packaging.* Before auditing.

Industry division		Per cent
911	Municipal engineering	68
9124	Central govt. admin., health/social	57
9316	Vocational schools for agriculture	33
9318	Universities and colleges	61
932	Research and scientific institutes	67
933	Health and veterinary services	47
93421	Homes for the aged	69
Total		53

8.4. Time spent by suppliers of the data

The 201 respondents who stated how much time they had devoted to the questionnaire, used a total of 285 hours to complete it. This gives an average of 85 minutes per establishment (Table 19).

Table 19. Average time used to complete the questionnaire, by industry division. Minutes.

Industry division		Minutes
Mean		85
911	Municipal engineering	112
9124	Central govt. admin., health/social	34
9316	Vocational schools for agriculture	60
9318	Universities and colleges	215
932	Research and scientific institutes	78
933	Health and veterinary services	66
93421	Homes for the aged	76

8.5. Data input and error checking

The actual data input via the registration image in QBE Vision presented few problems, and went better than in 1994. An average of 5.3 minutes was spent on each questionnaire, making a total of 25 hours.

8.6. The tables

Table production went more easily thanks to the experience we had from 1994. SQL sentences were written with selections in QBE Vision. Tables with sub-headings were transported to Excel

spreadsheets, where they were edited. It took some time to learn which SQL sentences were best suited to our tables.

9. MAIN FIGURES

9.1. Assumptions

Our point of departure was that these statistics would be based on information from the generators of the waste. The figures have not, therefore, been adjusted in the light of any other information we may have obtained from the waste transport companies, waste sorting facilities or landfills.

The figures obtained are based mainly on estimated quantities of waste. 42 per cent of the establishments stated that the reported quantities were based on experience or estimates, 7 per cent that they were based on weighing, 3 per cent that they were based on converting volume into weight, and 26 per cent stated that the quantities had been arrived at by a combination of weighing, conversion of the figures, and estimates. 22 per cent made no reply to this question.

We have chosen to combine some sectors in our presentation of the waste quantities:

Industrial division		Presentation group
911	Engineering sector →	Engineering sector
912 933 93421	Central government health/social Health and veterinary services Homes for the aged →	Health/social
9316 9318 932	Vocational schools for agriculture Universities and colleges Research and scientific institutions →	Education

9.2. Total quantities of waste generated

When the figures were weighted in order to estimate the distribution for Norway as a whole, we obtained a total quantity of waste arising in the industries that were included in this survey of about 406,000 tonnes. The quantity of hazardous waste was about 4,000 tonnes (Table 20).

Table 20. Total quantities of production and consumption waste and hazardous waste from the industries that participated in the survey. 1994. Round figures in tonnes

Industry	Total	Production and consumer waste	Hazardous waste
Engineering sector	328 000	327 500*	550
Health/Social	69 800	66 700	3 100
Education	8 600	8 200	350
Total	406 400	402 400	4 000

* Mineral waste such as stone, gravel and concrete comprises 240 000 tonnes.

When the waste quantities were classified by material, it appeared that mineral waste (stone, gravel and concrete) comprised 60 per cent of all the waste generated (Figure 1). This is waste that has been generated in conjunction with highways construction by the municipal engineering departments and deposited on separate, temporary landfills or used as fill materials. **From this point on all mineral waste is excluded from the calculations, and Figures 2-10 therefore represent a classification of 162,000 tonnes** (402,000 - 240,000) (Figure 2).

The great bulk of the hazardous waste came from health and veterinary services and consisted mostly of infectious waste (Figure 3). According to the calculations, the quantity of hazardous waste in 1994 was 4,000 tonnes. Of this, infectious waste comprised 48 per cent (1,900 tonnes). After this the biggest groups were photographic chemicals (950 tonnes) and waste oil (450 tonnes).

Figure 1. Calculated quantities of production and consumer waste, total quantities minus mineral waste. 1994. Tonnes

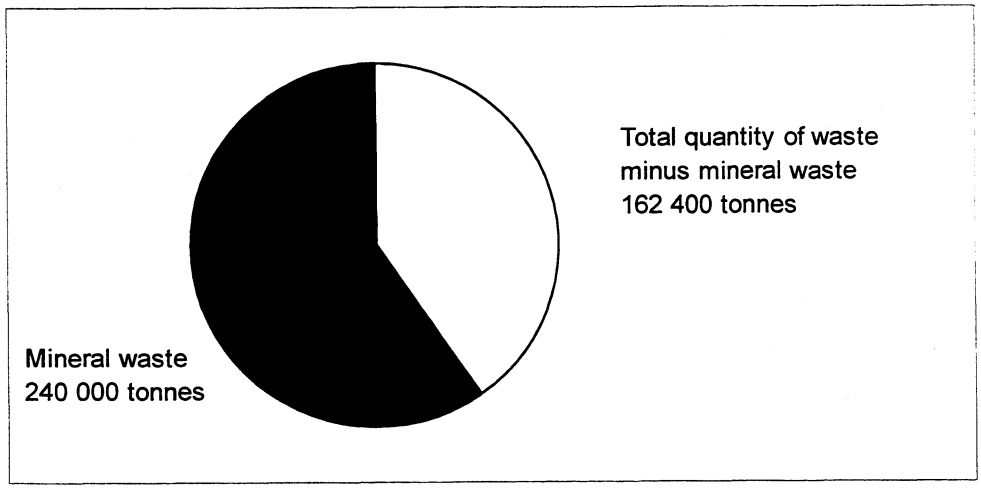


Figure 2. Calculated quantities of production and consumer waste, total quantities minus mineral waste. 1994. Tonnes

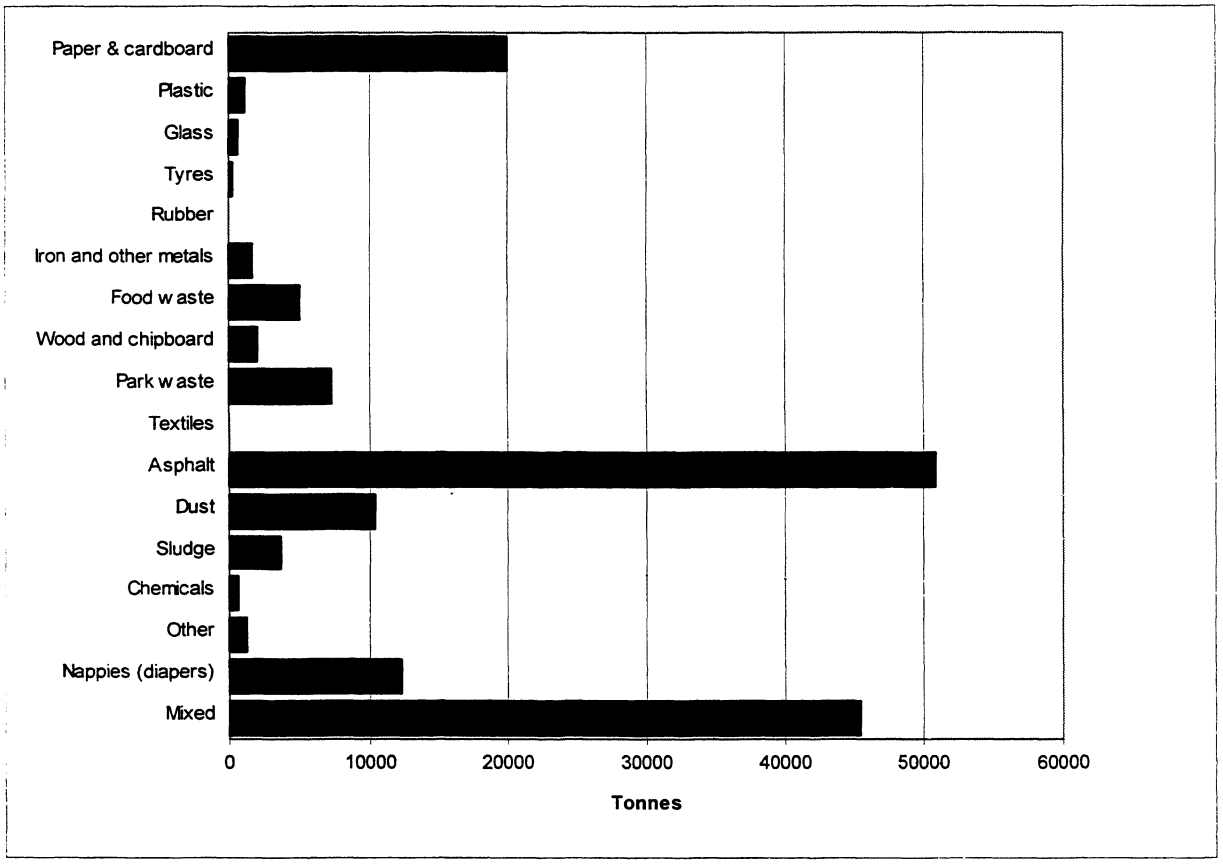
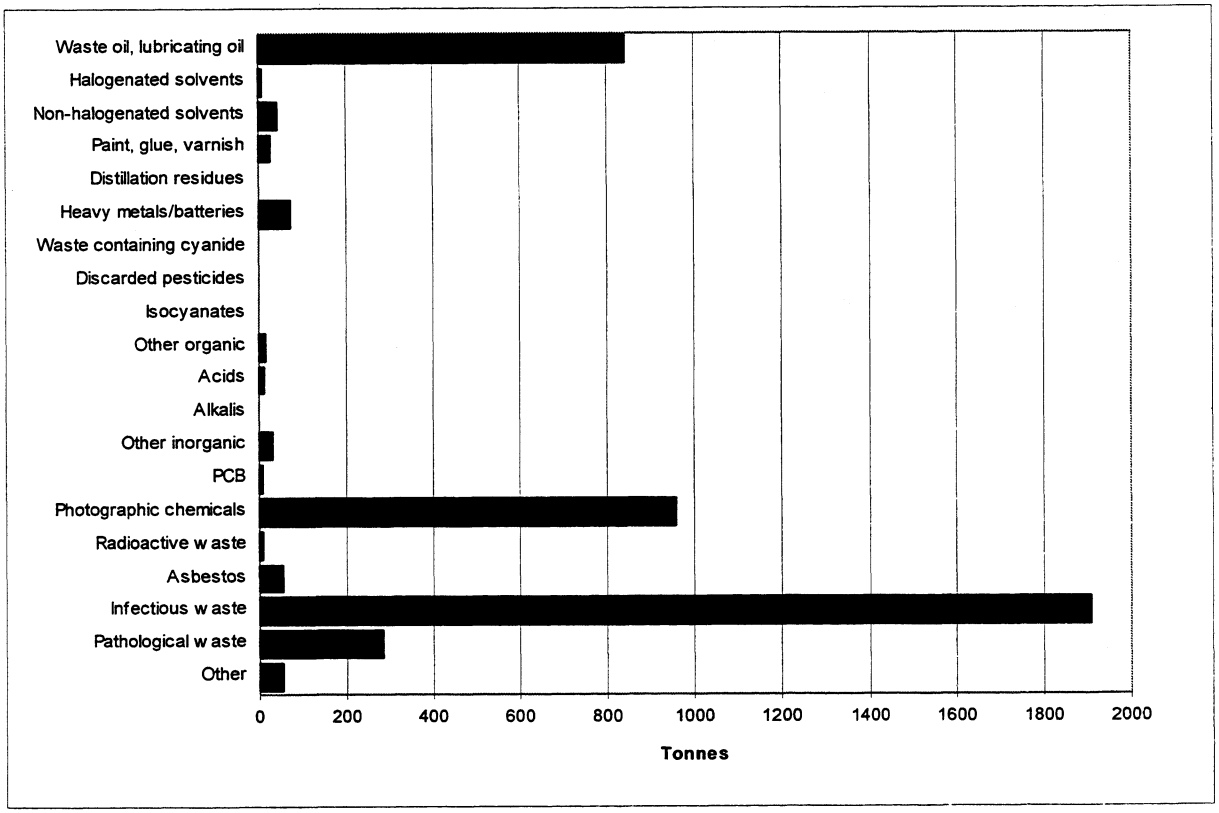
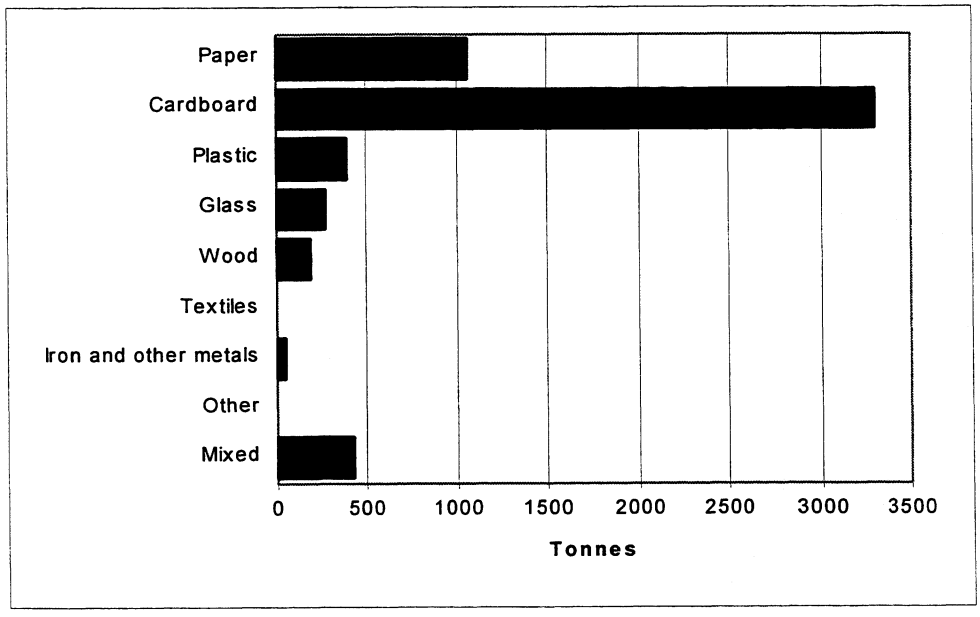


Figure 3. Calculated quantities of hazardous waste, by group. 1994. Tonnes



Packaging comprised 3.5 per cent (5,700 tonnes) of the production and consumer waste. Of this, 77 per cent (4,400) was paper, cardboard and carton. Plastics accounted for about 7 per cent (400 tonnes). Glass, wood, iron and other metals made up 9 per cent, and the rest was mixed packaging (Figure 4).

Figure 4. Calculated quantity of packaging. 1994. Tonnes



9.3 Waste management

The great bulk of the waste ended up in landfills. Whereas 55 per cent ended up on the establishment's own or the municipal landfill, only 10 per cent went to materials recycling and 5 per cent to incineration (Figure 5). The rest was by and large used as fill materials (85) or stored temporarily. 25 per cent (40,000 tonnes) of the production and consumer waste was managed on own premises in 1996 (Figure 6). That is to say, it was deposited in the establishment's own landfill (7,500 tonnes), stored (30,000 tonnes), or flushed down the sewer system (1 tonne). *Own landfill* by and large means park waste and sweepings from roads and pavements deposited on temporary landfills under the supervision of the municipal engineering department.

By way of comparison, industry delivered 26 per cent of its waste to recycling in 1993, incinerated 29 per cent and deposited 28 per cent in landfills; the rest was biologically treated, used as fill materials or managed in another way(SN 1995a). Of the municipal waste in 1994, 12 per cent went to materials recycling (as did 16 per cent of the household waste), 18 per cent was incinerated with energy utilization, whereas about 69 per cent was deposited on a landfill (SN 1995a).

Figure 5. Classification of production and consumer waste by management method. External management. 1994 in per cent.

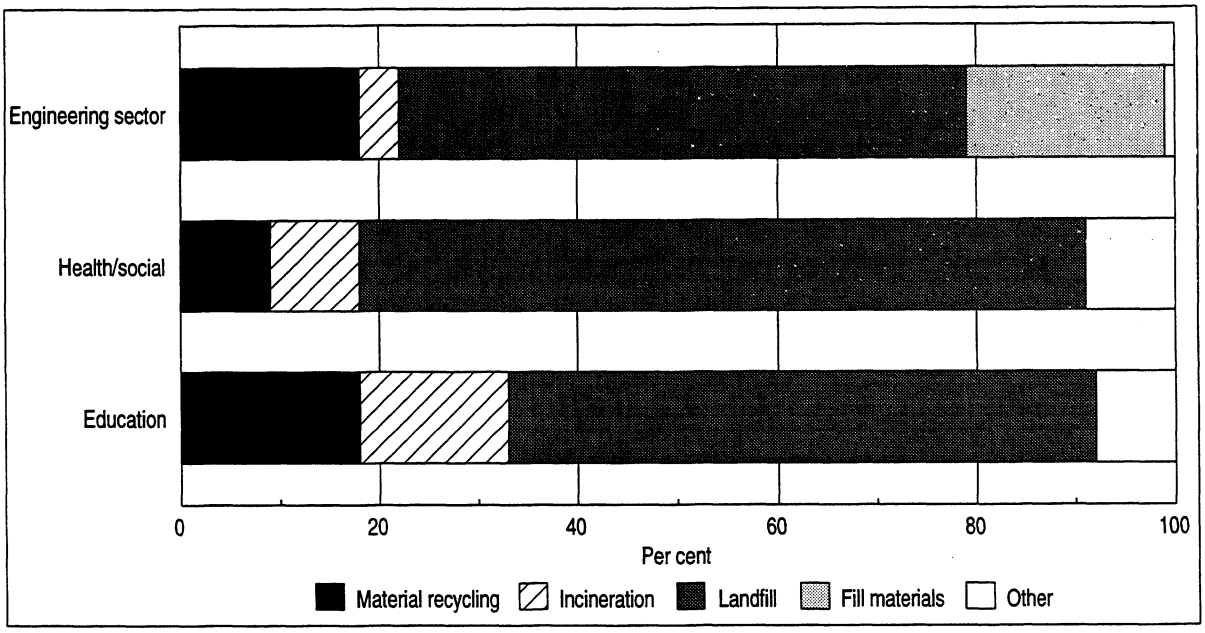
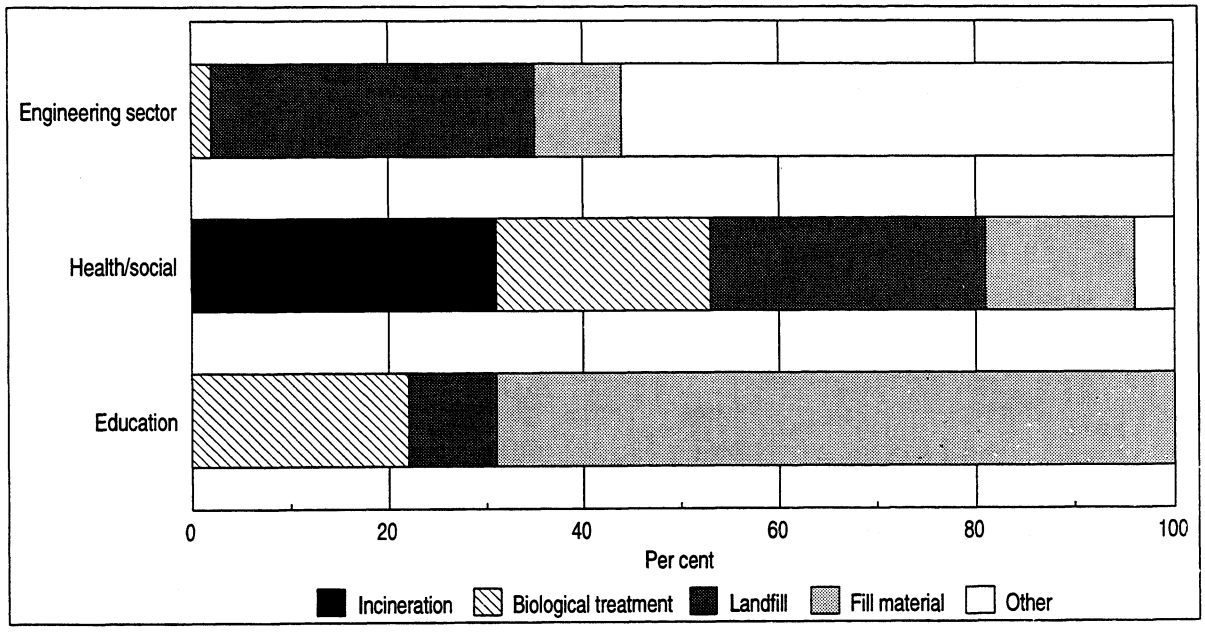


Figure 6. Classification of quantities of production and consumer waste by management method. Own management. 1994. Per cent



82.5 per cent of the hazardous waste was delivered to an approved external treatment facility, whereas the rest (690 tonnes) was subjected to one or another form of own management (Figures 7 and 8). *Own management* includes storage (17 per cent), incineration (44 per cent) or delivery of the waste to municipal landfills in company with other waste (2 per cent). It was not registered that hazardous waste ended up in own landfills. 4 per cent of the hazardous waste, 157 tonnes, was flushed down the municipal sewer system.

Figure 7. Classification of hazardous waste by management method. 1994. Per cent.

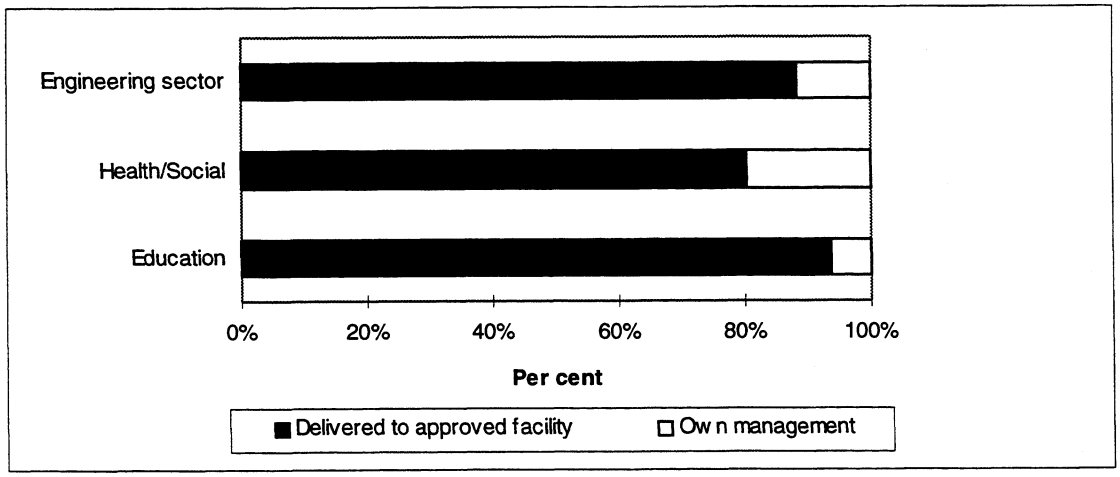
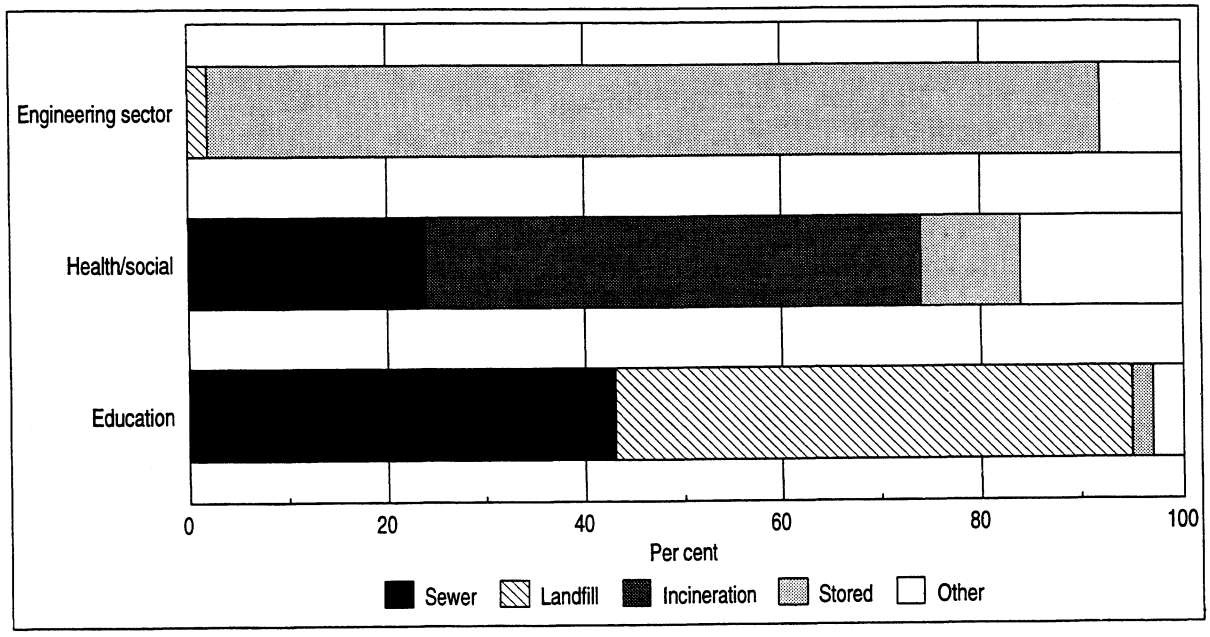


Figure 8. Classification of hazardous waste subject to own management, by management method. 1994. Per cent



It was mostly asphalt that was recycled (Figures 9 and 10), but the recycling percentage was highest for car tyres - in all 53 per cent of this waste was handed in for recycling. In all, 48 per cent of the glass waste was returned for recycling. Of paper, cardboard and carton, 31 per cent was returned for recycling, while 9 per cent was incinerated and the rest ended up in landfills. Of iron and other metals, 43 per cent was delivered to recycling, whereas for food, slaughterhouse and fish waste 31 per cent was recycled. Not much of the wood waste was incinerated, only 3.6 per cent.

Figure 9. Classification of production and consumer waste by material and treatment. 1994. Per cent

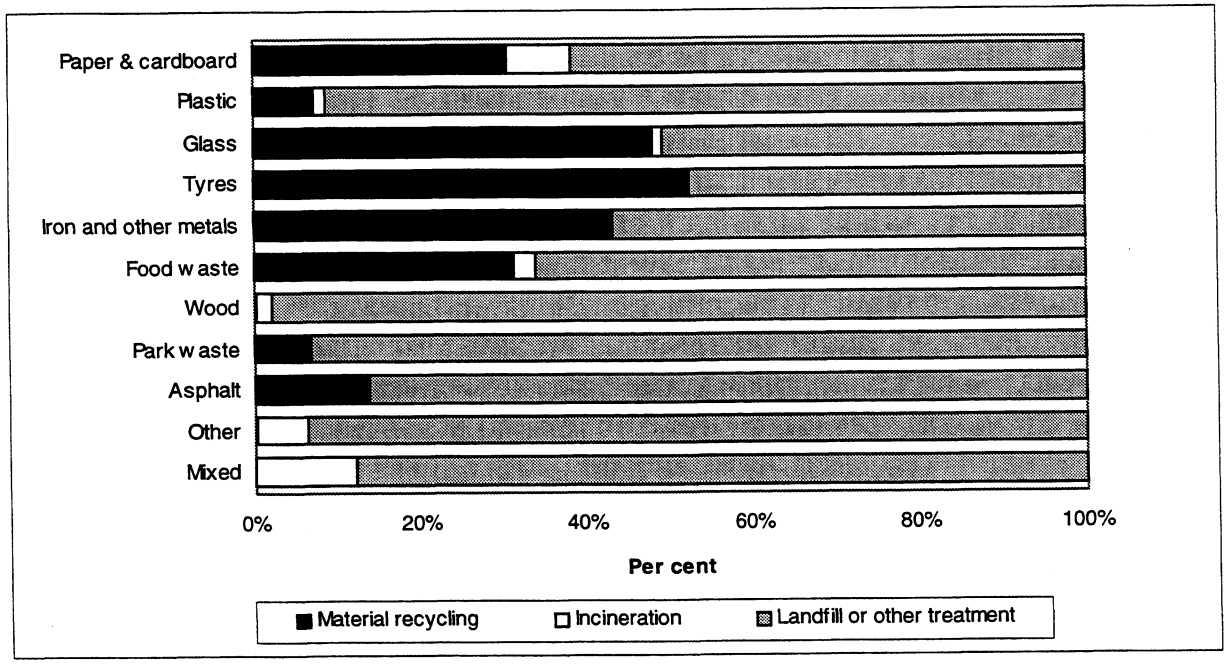
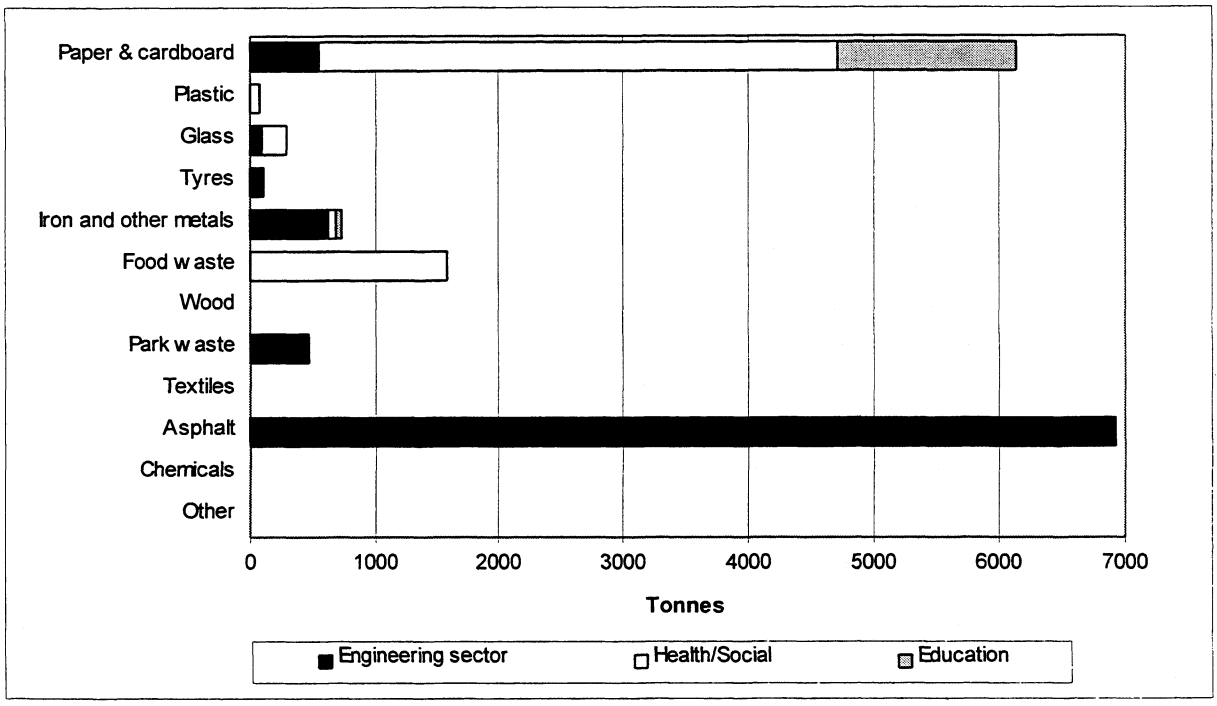


Figure 10. Calculated quantities of waste delivered for recycling, by industry and materials. 1994. Tonnes



9.4. The quality of the main figures

The figures reproduced here are not quality-assured to any great extent, in the sense that comparison and verification have proved difficult.

The greatest uncertainty is related to the treatment part. The establishments knew little about the external disposal of the waste. What happened to the waste after it was put in a container was a subject they had few or no opinions about. The most difficult question was the classification between what was recycled, incinerated and deposited in landfill. We accepted what the establishments listed in the way of quantities delivered to recycling and did not check with the first-hand recipient as regards how much was really recycled and how much dumped. We are aware that the percentage presented as recycled in figures 5, 9 and 10 is probably too high, in the light of the fact that some no doubt ends up in landfills in the second-round treatment. On the other hand, some of the waste entered under Sorting (in all 2,400 tonnes) will join the waste for recycling.

It was stated that about 3,300 tonnes hazardous waste was delivered to approved external treatment facilities. This would appear to accord well with NORSAS' figures for quantities delivered. In 1994 the NORSAS system took in a total of 91,963 hazardous waste. Of this, about 3,571 tonnes came from the categories 91 *Public administration, police and justice system* (Armed Forces excepted) and 93 *Education, health and other social services* (NORSAS 1994). NORSAS' figures include several more sectors and should thus be larger than our figures.

There was less packaging than expected (3.5 per cent of the waste).

10. CONCLUSIONS

The conclusions of the survey may be listed as follows:

** When the figures were weighted to obtain an estimate for the distribution on a national basis, we got a total quantity of waste generated by the sectors embraced by this survey of about 406 000 tonnes. Of this, 240 000 tonnes was mineral waste and about 4 000 tonnes hazardous waste.

** More than half the waste ended up in landfills. Only 10 per cent was delivered for materials recycling, and 5 per cent was incinerated. The rest was used as fill material, stored, biologically treated or dealt with in other ways. Mineral waste has been excluded from these calculations. 82.5 per cent of the hazardous waste was delivered to approved disposal facilities, while the rest was managed on own premises.

** The uncertainty affecting the figures is severe. The figures are nevertheless the best we have today, and they give a pointer to the order of magnitude of the waste quantities in parts of the public sector. The figures must be employed with caution, and their limitations must always be borne in mind.

** Comparisons with the 1994 sample survey with a view to resource utilisation shows that use of interviews in 1994 yielded a higher response rate (99 to 88 in this postal survey), reduced use of telephone for auditing (37 per cent of the establishments were telephoned in 1994 as against 61 per cent in 1995) and reduced time spent on auditing (about 12 minutes per questionnaire in 1994 contra about 21 minutes in 1995). The time spent by the respondents to complete the questionnaires was about 42 minutes in 1994 versus about 85 minutes in 1995.

** The questionnaire functioned well.

** The units are in general not unwilling to provide information about their waste. However, if we compare with last year's survey (SN 1995a) we find a greater reluctance in parts of the public sector than in private industry.

** The establishments know a certain amount about their waste, but not much about its management. Very many have lease agreements that includes rubbish collection; the costs of this and the quantities are not specified.

** We received replies about quantities of hazardous waste, and hazardous waste should also in the future be included in surveys.

** It is difficult to use the Establishment Register before it has been updated in conformity with new industry standards.

** It has not proved possible on the basis of the results obtained from this survey to measure unambiguous coefficients for the relationship of *waste quantities* to *number of employees*.

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MEMORANDUM
KAU
SN
13th June 1994

Use of fines in connection with data-gathering for waste and recycling statistics in trade and industry 1993.

1. Background

Data for the above-mentioned statistics are obtained under the authority of the Act on Official Statistics and Statistics Norway of 16th June 1989 No. 54.

In all 1646 establishments are included in our sample, which had an original reply deadline of 15th April 1994. Reminders were sent on 13th May 1994 to 146 establishments with a new reply deadline of 1st June 1994 (reminders were not sent to establishments in Oslo, Bergen and Trondheim because the interviewers there were not yet finished with their jobs). To date we lack replies from 57 establishments (+ possibly some in Oslo, Bergen and Trondheim). The size of these companies regarding number of employees is shown in the table below:

Number of employees	Number of establishments
0 - 10	17
11 - 50	21
51 - 100	5
>100	14

2. Use of fines by SN

The purpose of the fine is firstly to compel reluctant suppliers of data to provide information. It is also important to prevent weak information response when reporting is mandatory. Fines may help to make the collection of data more effective and will substitute criminal charges.

Fines may only be used with the surveys where reporting is mandatory.

The draft *Use of Mandatory Reporting and Fines by the Administration Department HRS/PLø* proposes that fines must be used in connection with the annual statistics in all areas, and that fines may be used in connection with short-term statistics.

3. Use of fines for the waste statistics

The Statistics Act empowers us to impose mandatory reporting. However, our questionnaire does not expressly draw the data suppliers' attention to the fact that reporting is mandatory.

No decision has been taken as to whether this survey is to be repeated and, if so, whether it is to be an annual statistic or is to be presented only every few years. This decision will be taken in consultation with the SFT this autumn.

Collection of fines is very heavy on resources. It is extremely likely that the remaining establishments have little notion of their own waste and therefore have problems in completing the questionnaire. If we insist on getting the questionnaires back, in all probability the figures will be useless.

4. Conclusion

Because we did not specify anywhere that reporting was mandatory, and because collection of fines is highly resource-intensive and will probably not yield results in terms of the waste statistics, we propose that for this first year's edition fines should not be used - despite the fact that there are some large establishments which have not returned our form. Since we do not know whether the survey will be repeated, we propose that instead of fines we send the establishments which have not replied a second reminder with a deadline of 1st July 1994.

Appendix 2a

To Senior Management

Oslo, 8th June 1995
Your ref.: Our ref.: 95/01303 KAu
Case Officer: Åse Kaurin (direct line 62 88 54 03)

Waste statistics from the public sector

Statistics Norway is preparing routines for collection of reports on waste from industry and the public sector. The work is anchored inter alia in Storting Report No. 44 (1991-92) on *Action for Minimisation, Increased Recycling and Responsible Management of Waste,* which points out the need for official statistics on waste and recycling.

As part of this work of investigating public-sector waste, we have selected in all 300 reporting units. A reporting unit may be a hospital, a medical centre, a technical college, a university or a municipal engineering department. It is important that the information regarding the waste comes from *all* activities in the unit that is selected and that is stated on the first page of the questionnaire.

Your unit is asked to reply on the appended waste quantity and waste management questionnaire.

The data are collected under the authority of the *Act on Official Statistics and Statistics Norway of 16th June 1989 No. 54.* Pursuant to this Act the data supplier is legally obliged to provide the necessary information and to return the form within the deadline. SN's employees have a duty of confidentiality regarding information from the individual data supplier, who will therefore not be identifiable when the results are published. SN is collaborating with SFT on the design of the statistics.

If you have any problems completing the form, you may contact the following persons:
Åse Kaurin, tel.: 62 88 54 03
Eva Vinju, tel.: 62 88 54 76

The deadline for return of the form to Statistics Norway is 30th June 1995.

SN hopes for your full co-operation and thanks you in anticipation of your assistance.

Yours sincerely,

Svein Longva

To Senior Management of Engineering Services

Oslo, 8th June 1995
Your ref.: Our ref.: 95/01303 KAu
Case Officer: Åse Kaurin (direct line 62 88 54 03)

Waste statistics from the public sector

Statistics Norway is preparing routines for collection of reports on waste from industry and the public sector. The work is anchored inter alia in Storting Report No. 44 (1991-92)on *Action for Minimisation, Increased Recycling and Responsible Management of Waste,* which points out the need for official statistics on waste and recycling.

As part of this work of investigating public-sector waste, we have selected in all 300 reporting units, including the engineering services of 40 municipalities.

Your engineering services department is asked to reply on the appended waste quantity and waste management questionnaire.

The municipal engineering sector should report only the waste generated by their own activities. Any waste collected from other activities, such as sewage sludge and waste from business and private households, should not be included. Waste from fields of work previously done by the municipal engineering services but now outsourced to the private sector should not be included either.

As the organisational structure of the municipalities varies so widely, we would like to specify which activities should be included in the reporting of waste from engineering services: Administration of engineering services, maintenance/snow clearance/gritting/salting etc. of roads and open spaces, construction/reconstruction/renovation/demolition of buildings, any caretaker functions, operation of water/sewage treatment plants, operation of waste disposal plants, operation of the parks service etc., the fire service, and any workshops for maintenance of own vehicles and equipment.

The data are collected under the authority of the *Act on Official Statistics and Statistics Norway of 16th June 1989 No. 54.* Pursuant to this Act the data supplier is legally obliged to provide the necessary information and to return the form within the deadline. SN's employees have a duty of confidentiality regarding information from the individual data supplier, who will therefore not be identifiable when the results are published. SN is collaborating with SFT on the design of the statistics.

If you have any problems completing the form, you may contact the following persons:
Åse Kaurin, tel.: 62 88 54 03
Eva Vinju, tel.: 62 88 54 76

The deadline for return of the form to Statistics Norway is 30th June 1995.

SN hopes for your full co-operation and thanks you in anticipation of your assistance.

Yours sincerely,

Svein Longva

Appendix 3

Confidential

Statistisk sentralbyrå
Statistics Norway

P.B. 1260, N-2201 Kongsvinger
Contact: Åse Kaurin, tel. 62 88 54 03
Eva Vinju, tel. 62 88 54 76

To be returned by 30 June 1995

Data on waste and recycling 1994
Public Sector

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

Units in public sectors have been selected to participate in a survey for the purpose of procuring national statistics on waste and recycling.

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.

001	New address: 010		
	Contact: 011		
	Tel.: 012	No. employees: 020	

A. Quantity of production and consumer waste from own activities (Including packaging, excluding hazardous waste)

Component (material)		Tonnes
Paper	110	
Cardboard	111	
Plastic (incl. styrofoam)	112	
Glass	113	
Tyres	114	
Rubber (excluding tyres)	115	
Iron and other metals	116	
Food, slaughterhouse and fish wastes	117	
Wood wastes	118	
Park wastes (excl. stones, gravel, soil)	119	
Textiles	120	
Stone, gravel and concrete	121	
Asphalt	122	
Ash	123	
Dust (e.g. filter/coal dust)	124	
Sludge	125	
Chemicals	126	
Other, specify	127	
	128	
	129	
	130	
Mixed, unknown	148	
Total	149	

B. Quantity of hazardous waste from own activities

	Category		Kg
According to regulations of 10 April 1984	Waste oil, lubricating oil etc.	150	
	Oily waste from separators	151	
	Oil emulsion	152	
	Halogenated organic solvents	153	
	Non-halogenated organic solvents	154	
	Paint, glue, varnish and printer's ink	155	
	Distillation residues and tarry waste	156	
	Waste cont. heavy metals/batteries	157	
	Waste containing cyanide	158	
	Discarded pesticides	159	
	Isocyanates	160	
	Other organic wastes	161	
	Strong acids	162	
	Strong alkalis	163	
	Other inorganic wastes	164	
	Waste containing PCB	165	
Other regulations	Photographic chemicals	166	
	Radioactive wastes	167	
	Asbestos	168	
	Infectious wastes	169	
	Other, specify	170	
		171	
Total		199	

RA-0093E 5.95.

2

C. Disposal of 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	200			
		201			
		202			
		203			
		204			
	Incineration with utilization of energy	205			
		206			
		207			
		208			
	Incineration without utilization of energy	209			
		210			
		211			
		212			
	Sent to a sorting facility	213			
	Biological treatment	214			
	Deposited on landfill	215			
	Used as fill material	216			
	Other, specify	217			
Total		249			General comments to the questionnaire
Managed on own premises	Incineration with utilization of energy	250			
		251			
		252			
		253			
	Incineration without utilization of energy	254			
		255			
		256			
		257			
	Biological treatment	258			
	Deposited on landfill	259			
	Used as fill material	260			
	Drained to a sewer pipe	261			
	Other, specify	262			
Total[1]		299			

[1] The totals of items 249 + 299 should equal item 149.

D. Disposal of hazardous waste from own activities

		Category of hazardous waste	Kg	Delivered to (Name of recipient)
Delivered to approved external treatment facility	300			
	301			
	302			
	303			
	304			
	305			
	306			
	307			
	308			
	309			
	310			
				Method of management
Managed on own premises	312			
	313			
	314			
	315			
	316			
	317			
Total	349	(= Item 199)		

E. Quantities of waste packaging
(Specified data)

Component		Tonnes
Paper	350	
Cardboard	351	
Plastic (incl. styrofoam)	352	
Glass	353	
Wood	354	
Textiles	355	
Iron and other metals	356	
Other, specify	357	
	358	
Mixed, unknown	368	
Total	369	

H. Time used

State how long it took to fill in the questionnaire (minutes):

370

F. How has the quantity of waste been calculated?

The reported figures for quantities of waste are based on *(indicate by an X)*

Weighing the waste	1	☐
Conversion from volume to weight	2	☐
Earlier experiences/estimates	3	☐
Combination of more than one method	4	☐

371

G. Conversion factors

If the figures in A or B were converted from volume to weight, what conversion factors were used?

Material	Conversion factor

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 1994.

A. Quantity of production and consumer waste from own activities. (Including waste packaging, excluding hazardous waste)

Waste that <u>should not</u> be reported in block A.

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

Waste that <u>should</u> be reported in block A.

- <u>All</u> 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 production and consumer waste.

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

In box 117 *Food, slaughterhouse and fish wastes* dead animals <u>not</u> representing a potential contagious risk, should also be included.

Park wastes, box 119 should include twigs, branches, grass etc. from parks and similiar areas. Garden wastes from households should <u>not</u> be included.

By *Mineral waste*, box 121, is meant stones, gravel, slag, concrete, bricks etc.

Chemicals, box 126, refers to chemicals that are <u>not</u> 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 127 to box 130. 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 148.

B. 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).

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 box 170 or 171.

<u>NB!</u> The quantity of hazardous waste shall be reported in <u>kilograms</u>.

C. Disposal of production and consumer waste from own activities. (Including waste packaging, excluding hazardous waste)

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. A).

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 217 (external facility) and/or box 262 (own premises/treatment plant). Specify how this waste is disposed of.

The number of tonnes of industrial waste reported in box 149 shall be equal to the number of tonnes of industrial waste reported in box 299.

D. Disposal of hazardous waste from own activities

The hazardous waste shall be reported under the same categories as in block B. 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 1994, then the quantity stored should be reported under *Managed on own premises*. The number of kilograms of hazardous waste reported in box 349 should be equal to amounts reported in box 199.

E. 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 A. If the waste packaging consisted of components other than those listed under E in the questionnaire, this shall be specified under *Other, specify*, box 357. 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 368.

General remarks

If you have any comments to the questionnaire or to the data collection method, please put them in the box on page 2, *General comments to the questionnaire*. Here you can also put any possible remarks concerning information given by you in the questionnaire.

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