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Norwegian Economic and Environment Accounts (NOREEA) Phase 2

Norwegian Economic and Environment Accounts (NOREEA Phase 2) Project

2000 Final Report to Eurostat

Project/contract no 9 412 002

31 October 2000
Rev 4. December 2000

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1. Project overview

The *NOR*wegian *E*conomic and *E*nvironmental *A*ccounts Project (NOREEA) was first established in 1997 as a co-operative project between the Division for National Accounts and the Division for Environment Statistics at Statistics Norway. The funding for this long-term project has come from Eurostat and the Norwegian Ministry of the Environment. The present report applies to phase 2 of the overall program that runs from 1998 through 2000. The project objectives and expected results for phase 2 of this project include:

- Revised natural assets accounts for Norwegian forests
- Making extensions and updates to the Norwegian NAMEA-system
  - Study data possibilities for extending accounts of solid waste to cover more types of waste
  - Test implementation for emissions of metals to water
  - Test implementation for emissions of phosphorus and nitrogen to water
  - Produce updated data tables for air emissions with an extended time series of data (1991-1997).
- Producing a SERIEE analysis of public sector wastewater

In addition, estimates for environmental protection investment in industry have now been completed and a report in Norwegian has been published (Hass et al. 2000, for downloading report as pdf-file see: http://www.ssb.no/emner/01/06/20/rapp_200017/rapp_200017.pdf). This work was unfortunately delayed by several months due to the delays in the publication of the industry statistics.

Progress was made in all six areas. For some of the test calculations it was possible to go further than in other areas. The progress often depended on the development of the statistics for that area in general. The revised natural assets accounts for forests, the evaluation of solid waste statistics and the updating of the air emissions tables were all areas in which good progress was made. The test implementation for emissions of metals to water was also relatively successful but additional data revision work is needed as well as discussions with the Norwegian Pollution Control Authority before further progress can be made. The test implementation for phosphorus and nitrogen was made but in order to obtain reliable results there is still a need for more information than is currently available. The SERIEE analysis of public sector wastewater has unfortunately not been able to progress as far as filling in the various SERIEE tables. Due to the ongoing development of the municipal to state data reporting system (known as "KOSTRA") and the implementation of the new COFOG categories this work is not yet able to be completed. Both KOSTRA and COFOG are nearing their implementation phase so more progress is expected in the near future.

Although some areas have progressed further than others, in general, this second part of the NOREEA project has produced valuable results that can form the basis for future work. The waste accounts that are currently under development will provide some of the best possibilities for additional detailed NAMEA-based work in the near future. This area should be able to be expanded next year since the results of the 1999 survey of the manufacturing industry will be completed and the waste accounts for a number of fractions will be updated and expanded according to these results. The NAMEA for air emissions will also continue to be refined. One area that needs to receive additional attention is the new Table 3 from the NAMEA-2000 Eurostat reporting tables. By systematically going through this table, the differences between the NAMEA air accounts and the air emissions reported to Eurostat, EEA and other international bodies that use more geographic definitions for Norway can be examined. This will help us double check if we have used appropriate definitions in our NAMEA air emissions tables and help to explain the differences between these two sets of data (NAMEA and "other" air emissions reporting). Additional detail for SERIEE will also soon become available due to the implementation of the new COFOG categories next year. These are all areas for which there are plans for further work.

2. Natural assets accounts: Norwegian forests

2.1 Introduction

In a report to Eurostat about the NOREEA project in 1998, problems regarding a resource account for forestry were identified. In that initial phase, there were still many questions that needed to be addressed. The following is an attempt to continue this work and bring the report to a preliminary conclusion, building on the conclusions reached in the previous phase. Since work phase 1 was completed, there has been further debate regarding different aspects of the assessment of forest wealth. As different countries and international groups have been engaged in this debate as well, some conclusions may be drawn from these experiences.

In SNA 1968, ESA 1978 and EAF 1987, the production in forestry and timber logging was defined as the felling of timber. However, in SNA 1993 and ESA 1995, growth in the cultivated forests is considered output and the timber accumulating is considered as work in progress until it is harvested.

After introducing ESA95/SNA93, around 1995, the National Accounts Division of Statistic Norway has, as an interim solution, calculated output as before, based on volume of timber felled, as if all forests in Norway are uncultivated.

Changes in the definition of output for forestry will not only influence the resource account for forestry but will also influence the National Accounts. Based on new information and improved methodology, revised figures will be compiled for the year 1998. The revision will be carried through with recalculating the National Accounts time series from 1998 and back to 1990. The plan is to publish the revised figures back to 1990 in 2002. The changed definition of forest output is expected to be part of the coming revision.

2.2 Summary and conclusions

Cultivation and resource rents

For environmental accounting purposes, our estimation is that 55 percent of the forest area of Norway is cultivated.

The growth of the cultivated part of the forest is faster than the non-cultivated forests. We estimate that 86 percent of the total growth of the timber is found in the cultivated part of the forests.

All timber, both commercially sold timber and timber felled for own account use, is assumed cut in the cultivated part of the forest. We will argue that this comes in the wake of our definition of "natural forest" in Norway.

A result of this is that there is no production in non-cultivated forest (since production in the non-cultivated forest should be equal to felling of timber). Thus, it is most probably no intermediate consumption either; and no fixed capital or compensation of employees. So, the conclusion is that there is no resource rent in the non-cultivated part of the Norwegian forest.

We can focus on the cultivated part of the forest representing 86 per cent of the increment of wood. The main interest in this context will be measures of work in progress, and revision of value added and operating surplus.

Proposed changes to the National Accounts

A consequence of classifying a large part of the forests as cultivated, is that the growth of the standing timber will be included in production and investment in inventories (work in progress). In this chapter we discuss the valuation of this part of the production and estimates values for the 1991-1997 period.

We implemented a revision of the forest industry in the National Accounts for the years 1996 and 1997. The changes introduced a division of the forest industry into two industries: "Forestry" (NACE rev.1, 02.01) and "Services Related to Forestry" (NACE rev.1, 02.02). These two industries had been consolidated in the National Accounts for 1991-95. A new product was estimated for forestry for the year 1997, covering letting of hunting rights. For this report, these changes are extended to the whole period 1991-1997. These data are our proposal for the revised National Accounts. The present revision shall be finished in 2002, covering this period. Our National Accounts data cannot be considered as final until this revision has been finished.

2.3 To what extent are Norwegian forests cultivated?

2.3.1 Definition of forest production

According to ESA95 (§3.58, §3.119b) and SNA93 (§6.95, §10.106) forests as defined from an economic perspective are those forested areas considered as "cultivated forest." Their natural growth is to be treated as output and considered as work-in-progress in the national accounts. In addition, the output of uncultivated forests should be based on the volume of timber felled (SNA93 §1.23).

The treatment of the output from forests in the ESA95/SNA93 framework (§71 in Annex 1, SNA93) gives another possible interpretation, i.e. that Norwegian forests could be interpreted as characteristically natural but under human control. The output of forests of this kind is treated in the same way as entirely "natural forest" and not as "cultivated forest."

At an OECD-meeting on accounting for environmental depletion (OECD, 28.09.98), an attempt was made to define the difference between "cultivated" and "natural" assets. The basis for the discussion was this ambiguity found in SNA93. It was agreed that some more clarity was desirable in this area. From the paper of OECD:

> The SNA in the annex to chapter 13 defines produced assets to include cultivated assets elaborated as "...livestock...and...trees...under the direct control, responsibility and management of institutional units." This definition has given rise to doubts about how extensive the control and management is and whether control and management over off-take is sufficient to determine the asset be treated as produced. ... In defining non-cultivated biological resources, SNA is more precise. It states "...natural growth and/or regeneration is not under the direct control, responsibility and management of institutional units." That is control of off-take is not sufficient to determine that a natural asset is to be regarded as "produced." (OECD 28.09.98)

In the OECD meeting it was proposed to extend the definition of cultivated assets to include the phrase natural "growth and/or regeneration" as in: "livestock...and...trees...whose natural growth and/or regeneration is under the direct control, responsibility and management of institutional units."

2.3.2 Quantitative and qualitative characteristics of the Norwegian forests

The total land area of Norway is 306 808 km^2. Approximately 120 000 km^2 of this is forestland. Furthermore, approximately 74 000 km^2 is estimated to be productive forestland available for wood production, forestry and logging activities. The rest is considered unproductive forest including broad-leafed and spruce forests, pine, sedge and peat bogs, and forests above the coniferous line. Of the

productive forested land, only 85 percent are commercially exploitable (NILF 1998). We will see that this corresponds to the calculations of cultivated forests. Road density is rather high in the Norwegian forests. Only about 7 percent of the productive forested area lies more than two km from the nearest road, and approximately 1 percent is more than 5 km from the nearest road (ibid.). The stock of standing timber is estimated at 650 million m^3 and annual growth of wood is approximately 22 million m^3 in 1996.

The Norwegian forests are mainly boreal coniferous forests. The soil capacity of wood production is relatively low, the length of the rotation period is 60 - 90 years, and the renewability of the forest after cuttings is relatively high. In Norway, individuals own 95 percent of the forest properties. The rest is primarily owned by companies and by central and local government. Annually, less than 2 percent of the standing timber (calculated in m^3) is felled. This amounts to less than 50 percent of annual growth. Only harvesting half of the annual growth has resulted in the stocks of timber increasing over time. In the past century the volume of standing timber has doubled. This harvesting approach serves to maintain the timber reserves and the biodiversity of the forests as a whole.

Tables 1 and 2 show the forest balances in physical units and with a distribution by species for 1995. The figures shown in the grey areas in the table are estimates because annual levels cannot be measured directly. Protected forest is included in the figures. The information is gathered by Statistics Norway on the basis of information provided by the Norwegian Institute of Land Inventory (NIJOS). The National Forest Inventory made an assessment of the forests in the period 1986-1993. The county of Finnmark (the northern most county in Norway) was not covered in the assessment. However, Statistics Norway has estimated a figure for the forests in Finnmark.

NIJOS has established a sample of forest areas around the country. Every year they inspect these areas and measure the growth, natural losses and standing timber in m^3 on these areas. On the basis of these measurements, estimates of the total growth, natural losses and standing timber in m^3 are made for the Norwegian forest as a whole.

As it can be seen from Table 1, there is some uncertainty attached to the estimate of the forest growth. For example, revaluation amounts to more than roundwood cut for the year 1994. This may be due to changes in the assessment systems. The figures in Table 1 are the latest available estimates. Statistics Norway publishes these statistics in the *Natural Resources and the Environment* (Statistical Analyses Series).

The Norwegian Institute of Land Inventory has not made annual estimates on increment for the last years. Only four-year averages are estimated for the full-country assessment. To estimate the annual increase for each year is therefore a problem.

Table 1. Forest balance. 1 000 m^3 excluding bark.

	1991	1992	1993	1994	1995	1996	1997
Volume as of 1/1	578 317	588 476	599 243	609 399	633 302	650 845	651 688
Total drain	12 798	12 215	12 458	11 369	12 384	10 753	11 514
of this roundwood cut	10 332	9 779	9 957	8 952	9 812	8 682	9 047
natural losses, logging waste	2 466	2 436	2 501	2 481	2 572	2 071	2 467
Growth	20 485	20 921	21 337	20 859	22 557	22 376	22 303
Revaluation	2 472	2 061	1 277	14 413	7 370	-10 780	-
Volume as of 31/12	588 476	599 243	609 399	633 302	650 845	651 688	662 477

Sources: Statistics Norway: NOS Forestry Statistics 1991-1997; Natural resources and the environment 1993-2000

Table 2. Forest balance. 1 000 m^3 excluding bark. 1995

	Total	Revaluation	Spruce	Pine	Broad leafed
Volume as of 1/1/1995	633 302		288 418	207 033	137 851
Total drain	12 384		8 169	2 459	1756
of this roundwood cut	9812		6 876	1 907	1 029
natural losses	2 572		1 293	552	727
Growth	22 557		11 431	5 936	5 189
Revaluation	7 370				
Volume as of 31/12/1995	650 845	7 370	291 609	210 517	141 349

Source: Statistics Norway: NOS Forestry Statistics 1991-1997; Natural resources and the environment 1993-2000

Table 3. Forest balance. 1 000 m^3 excluding bark. 1996

	Total	Revaluation	Spruce	Pine	Broad leafed
Volume as of 1/1/1996	650 845		291 609	210 517	141 349
Total drain	10 753		7 000	2 161	1 592
of this roundwood cut	8 682		5 959	1 716	1 007
natural losses	2 071		1 041	445	585
Growth	22 376		11 454	5 991	4 931
Revaluation	-10 780				
Volume as of 31/12/1996	651 688	-10 780	299 618	221 249	141 600

Source: Statistics Norway: NOS Forestry Statistics 1991-1997; Natural resources and the environment 1993-2000

2.3.3 Norwegian forest policy, and the Forest Trust Fund

The main strategy for the Norwegian forest policy is outlined and discussed in the annual report to the Parliament:

> The major task of a forest policy is to lay the groundwork for a profitable utilisation of the forest resources both in the short and the long run, while maintaining and developing the forests' environmental value. The goal is to increase forestry's contribution to value added in the rural areas and to Norwegian economy in general. This is to be achieved by promoting competitiveness in the entire production chain and a sustainable resource management. Accordingly, the following are to be considered areas of priority:
> - sustainable resource management
> - satisfactory environmental considerations
> - increased value added (St. prp. nr. 1, 1997-98)

In the Forest Act, general intentions are emphasised more than strict regulations. The forest owners are left with some freedom to decide how to implement these intentions. Grants and tax exemptions, including the Forest Trust Fund, are used rather than strict orders and punishment. Nonetheless, some strict regulations exist. Fellings that are damaging the future development of the stand or cause danger to regeneration are prohibited. Building of forest roads has to be approved by the authorities. Special regulations with respect to environmental quality in particular areas are also provided in the Act (Framstad 1996).

The Forest Trust Fund is a Government fund. It is an arrangement established by the Forest Landowners Association to provide regeneration in the forest through economic incentives. Private land owners are required to place 5 - 25 percent of the gross value of timber sold in the fund. In the transaction of timber, the buyer subtracts the correct share from the invoice, and the amount is placed on the sellers' trust fund account. By placing the money on this account, the forest owner is allowed tax exemptions. A condition to keep the tax benefits is that money from the account is spent on certain

types of regeneration supporting activities (according to particular rules). Activities that can be financed by the fund are:

- Silviculture activities, like planting, thinning etc.
- Forest road constructions and maintenance
- Forest planning
- Professional education approved by the Ministry of Agriculture
- Forest drainage, but only in cases where drainage is necessary to obtain regeneration after felling. For other drainage an approval from the municipal authorities is required.
- Fertilising
- Silvicultural activities in order to enhance environmental goods and cultural heritage. (This provision was added in 1994.) (Ministry of Agriculture 1994)

In addition to the types of activities, as an overall condition, the activities have to be ecologically as well as economically defendable. For the first two activities mentioned, there are some exemptions, but these are too detailed to discuss in this context.

The interest earned and accumulated in the fund from the contribution of the forest owners is, as specified by the Forest Act, used for "the common benefit of the Norwegian forestry." This can for instance be Forest Owners Association, forest nurseries, seed orchards, professional education, forest planning, demonstration projects etc. The amount spent annually is 50 - 70 million NOK (Ministry of Agriculture, 1970-95). Since the forest owners are losing the interest earned on their contributions to the Forest Trust Fund by keeping their money on the fund account, they have a strong incentive to spend the money in forest regeneration activities.

2.3.4 Production in the Norwegian forests

When considering the production in the Norwegian forests, the problem of defining the relative shares of cultivated/uncultivated forests arises. Different approaches to define the area of cultivated forest in Norway have been tried.

One approach to define the area of "cultivated forest" is to evaluate the amount of human activity that is used in the forested areas to maintain and increase the forest yields. In other words, how much of the forest is being actively managed to ensure regeneration of the forests and afforestation? From the 1860s, there is documentation of activities related to planting/seeding and afforestation works in Norway. After 1932 the Forestry law requires forest owners to provide regeneration in the forest. It is possible to apply to the forest authorities for permission to use the area for other purposes, but permission must be obtained before a forested area can be used for another purpose. Furthermore, as we have already mentioned, the Government supports the forestry industry to some extent. These subsidies are meant to ensure an economic and ecological management of the Norwegian forest. The direct subsidies from the government correspond to 6-7 percent of the gross timber value (excluding supporting tax and fee policies). Subsidies are, inter alia, given to cover some of the costs of planting and reforestation work, and for compensation for the time spent on this kind of work. Subsidies for planting have existed since 1863. In addition, the Forest Trust Fund represents a strong incentive for the forest owners to invest in silviculture and forest regeneration activity. Based on this data, we find that a large part of the Norwegian forest is cultivated. Still, this approach does not lead to any clearly defined area, so the exact magnitude of the cultivated forest is not known.

Another approach is to start in the other end and use a method of elimination. Hence, the starting point is the total forested area of 120 000 km^2. By excluding areas that, based either on expert opinions, on evaluation criteria, or on both, can certainly not be accepted or defined as cultivated, the amount remaining will then be an upper limit to the area that can be defined as "cultivated."

The first approach supports the arguments that a part of the forest is, in fact, cultivated. However, as we do still not have any estimates, we must proceed with the second approach as a supplement.

In Norway there are some areas where after the seedlings are planted in the forest there is only modest human activity until the trees are harvested 40 to 90 years later. With this type of minimal human involvement in the forest management, it is questionable whether this type of forest area should be classified as being cultivated.

Nevertheless, we have decided to make an attempt to calculate the share of the Norwegian forest area that is cultivated. The forests in Norway are quite similar to the Swedish forests. Sweden is defining their forests as 100 percent cultivated. The Norwegian situation seems to be more mixed than the Swedish situation. For Norway there are three particular types of areas that must be subtracted from the productive forest area to achieve a good estimate on the relative share of cultivated/uncultivated forest. These are the areas that are not productive, that is areas producing less than 1 m^3 of wood per hectare per year of local species, under normal conditions. Secondly comes the forested areas in Norway that are totally sealed, either as national parks, as forest reserves, or simply preserved areas of forest. Finally, there are forest areas located too far away from the nearest road to be economically exploitable. All of these areas are considered "uncultivated" based on the discussion above. As a criterion for "too far away to be economically exploitable" we have used a distance of more than 2 km from the nearest forest road.

Table 4. Calculation of cultivated forest area:

Sources:	Total forested area:	120 000 km^2
NILF 1998, NOS forest stat., 1996	- Total area of non-productive forest: (120 000 km^2-74 000 km^2) (total area - productive area)	46 000 km^2
NILF 1998, ST.meld nr 40, 1994-95	- Total forests area protected as national parks, reserves, or just classified as protected forest (the part of this that are productive forest):	2 250 km^2
NILF 1998	- Total area of productive forests laying more than 2 km from the nearest forest road:	5 180 km^2
	= Maximal area of cultivated forest:	66 570 km^2

The estimates for productive areas of protected forests differ depending on the source of those estimates. For the current calculations we have chosen to use the estimate of 2 250 km^2 for the productive area.

This method of spitting the forest into the sub-groups of cultivated and not cultivated forest shows that at least 45 percent of the forest is non-cultivated, corresponding to an upper limit to the share of the forest land that is cultivated of 55 percent.

In a report from Norwegian Agricultural Economics Research Institute (NILF 1998), a measure on commercial exploitation (which is defined as an operating surplus ≥ 0) of the forest is presented. Based on this measure, the commercially exploitable forest area is 59 500 km^2. This represents a share of 49.6 percent of the total forested area. These results support our estimates of approximately 50 percent of cultivated forest area.

The increment in the forest, though, is not necessarily the same for different kinds of forests. Logically, the increment in the productive part of the forest is expected to be higher than the increment in the non-productive forest (given the same area). To calculate the increment in the cultivated part of the forest area we have subtracted the increment of non-productive forest (on which data are available), and deducted an assessment of the part of the increment that originate from productive forest but that is not defined as "cultivated." This assessment assumes the same average rate of growth of all categories of productive forest area. The calculations are shown in the following table.

Table 5. Share of the increment that stems from the cultivated part of the forest

Sources:		1996
	Total increment	22 376 000 m^3
NILF 1998, NOS, forest stat., 1996	- increment in non-productive forest (4%)	895 040 m^3
NILF 1998, ST.meld nr 40, 1994-95	- Total forests area protected as national parks, reserves, or just classified as protected forest (the part of this that is productive forest) (3%)	644 429 m^3
NILF 1998	- Total area of productive forests laying more than 2 km from the nearest forest road (7%)	1 566 320 m^3
	= increment in the cultivated forest (86%)	19 270 211 m^3

2.4 The value of forest production and wealth

2.4.1 Valuation principles of forest production

A report from Eurostat (2000, IEEAF), analyses principles of valuation of land and natural assets, dividing the assets, into three categories: (1) forest land, (2) cultivated timber and (3) non-cultivated timber and other non-produced biological assets.

In this report, we are primarily dealing with the forest asset. We are valuing the forest as a going concern, which means we are assuming that regeneration will take place unless active steps are taken to prevent it. This may be interpreted to imply that we are valuing the forest including the underlying land, not just the timber standing in the forest at the date of the balance sheet.

Provided that production is organised, managed and supervised by an institutional unit, output of standing timber for felling should be recorded as work-in-progress (EAF rev. 1, §2.06.13). It is a general agreement according to the EAF that in the case where standing timber (cultivated) does not fluctuate from year to year, the output is only to be recorded at the time of felling (and the standing timber is not to be considered as work in progress). Nevertheless, in Norway we are following the ESA 95, and consider growth of cultivated timber as output.

In the Eurostat (2000, IEEAF) report it is suggested to make a distinction between the mature timber and the immature standing timber. The sellers (and buyers) do not always invoice the "delivered to roadside" price for timber (i.e. accumulation of expenses for felling, hauling to the roadside and stacking the wood). When the timber is sold standing, the price entered in the EAF must include the costs of felling and delivery to the roadside (EAF rev. 1, §2.31.7). Mature, standing timber (not sold), on the other hand, should be measured at "stumpage price," which is the price of the timber as it stands uncut in the forest. This should be measured according to a series of relevant variables such as species, ages, locations and quality. Common problems with respect to observation of prices are in particular vertical integration and monopsonic markets (single buyer).

In Norway, the forest owner is traditionally covering the costs of hauling and stacking, while the road transport is covered by the industry.

When it comes to the immature standing timber, this has to be valued on basis of the net present value of timber at the time of felling (cultivated SNA93 §13.49 or not cultivated SNA93 §13.61). This means that we have to calculate receipts of the mature timber minus the expenses of bringing the timber to maturity, discounted to present value. This calls for data and assumptions. Pertaining to the future prices and costs, SNA93 suggests using the present prices and costs (this is according to converging experience). As to the discount rate, which also has to be "chosen", SNA93 proposes to derive this rate from information based on transactions in the particular type of assets under considerations rather than using a general rate of interest, such as one derived from the yield of government bonds (SNA93 § 13.34).

The value of standing timber is calculated as the present value of future profit. These future receipts are given by the stumpage value of the timber felled when mature. Using the volume of the forest with a specific age structure combined with the stumpage price, it is possible to calculate the present value in a simplified way.

For the Norwegian case we have chosen to use a relatively low rate of discount (3.5 percent) in the main example. However, we also calculate the resource rent and forest wealth using a higher rate (8 percent). In the case where the discount rate is low, the forest growth equals the effect of the discount rate during the growth period. This is an assumption used for the calculations. However, we actually observed a growth of 3.5 percent as an average for the years 1991-1997. With our choice of discount rate, our assumption is defendable also empirically, although we probably overstate the present value of the forest growth. This is more important when the discount rate is higher. In that case we can no longer ignore the discounting of future income from the forest growth.

There is an assortment of different methods for valuation. A distinction is made between the so called "consumption value method" and the "stumpage value method". The main difference between these methods is that the first is weighting the stumpage price by using the structure of the stock, while the other is using the structure of felling for the same purpose. Both are variants of the net present value method. If the stumpage value method is chosen, it is recommended to use average felling, and average prices, as these variables are, to some extent, interacting.

2.4.2 The strategy for calculating resource rents for Norway

In Norway, we use average prices and unit costs of the felling to calculate value of the growth of cultivated forests. This implies that we are using a kind of a simplification. We are using the total increment of the forest divided on species and quality. In fact that the natural rate of growth of the timber is not very different from the discount rate used. We assume that the net present value of the future resource rents from standing timber (mature and immature) more or less correspond to the unit resource rents as calculated for the forest industry for present year of observation. Multiplying the increment of the goods in progress in the cultivated forest (spread on different variables) with the present unit rents, we achieve a passable value for the net growth in stock of standing timber, in harmony with the recommendations in SNA93. The calculations are explained in further detail below.

To see the effect of calculating the production/ resource rent using different cases, we show both the previously used and the new case. In this manner, it is possible to get a picture of the sensitivity aspect of this matter. Treating the forest as cultivated brings you to one extreme, and using the not cultivated approach brings you to the other. Our result of 55 percent of cultivated area can be evaluated on this basis, and this at least gives an impression of the importance of the definition of cultivation with respect to production, resource rent and forest wealth.

The resource rent and forest wealth will also be affected strongly by the rate of discount. We will test the sensitivity matter of this rate as well.

2.4.3 Other non-produced biological assets and non-biological assets

In the future it is desirable for the calculations of other biological assets to contain valuations of hunting, berries, fishing, mosses etc. as well. Of course some of these assets are free, or an "open access regime" is prevailing for the resources, and can thus not be considered as economic assets in a SNA sense. Nonetheless, some of the resources are economically exploitable. The Norwegian National Accounts contain estimates for some of these products. These products are representing a relatively large production as compared to the total forest value, (and hence compared to the value of timber as well). The rationale of working out a broader estimate of forest wealth is that Norwegian forestry is emphasising the importance (as mentioned above) of sustainable resource management, environmental conditions, biodiversity, etc. Hunting activities are of particular interest. The estimates for hunting have improved from 1997 onwards, and are part of the resource rent estimates. A

production (and cost) of the forest that could possibly be estimated is the use of forests as grazing land for produced animals. However, these assets are not included in current estimates of forest wealth.

The forest is also producing other services or amenities. Some of these are difficult to assess in terms of fixing a price in a SNA sense. Methodology for assessment of these kinds of values, however, is developing continuously. Hence our expectations for the future are positive for appraisal of these services. This is the case for services like maintenance of biodiversity, protection against erosion, value of landscape, etc. Carbon storage, on the other hand, has until recently been in the same category, but as the establishment of a market for CO_2 emission permits is approaching, it may be possible to incorporate this as a distinct contribution to the forest value. The standing volume in the Norwegian forest, including bark, stumps, branches and roots, is calculated to constitute a stock of approximately 930 million tons CO_2-equivalents. The Norwegian Emissions of CO_2 were about 40,7 million tons in 1996. Calculations propose that annual net sequestration of CO_2 (of increment net of fellings and natural losses) is 36 percent of the Norwegian CO_2 emissions in 1995 (Ministry of Agriculture, St. meld. nr. 17, 1998-99).

Recreational use is another aspect of relevance as a contributor to the value of the forest resource. Typically the recreational use is defined as "free." Still, the values of these free services are possible to quantify through a number of methods such as contingent valuation, travel cost methods etc. This has been done for limited areas, but not at a national level in Norway. Yet, we expect progress on this field in the future.

2.4.4 Calculation of production and forest resource rent

In this section we present estimates of forest resource rent and forest wealth. The first, referred to as **case A**, values the production as in the National Accounts until 1997, but with revised figures for production and intermediate consumption. In this case we assume that all forest is uncultivated. The second estimate, **case B**, assumes that 55 percent of the forest areas are cultivated and 86 % of the increment is cultivated. We assume that production only appears in the cultivated part of the forest. We claim that this is close to the truth according to the definition of cultivated and non-cultivated forest. In this case we use the same terminology as in case A, deriving a resource rent for forestry which in turn is discounted for the rotation period, forms the basis for the forest wealth estimate. The third estimate, **case C**, build on the same assumptions as case B, but in stead of deriving the resource rent for the forestry (one can argue that there is no resource rent in this case), we focus on the value added and operating surplus for the forest industry. This is our suggestion for the National Accounts. From a preliminary test for 1997, the case will be improved and implemented in the National Accounts during our next revision. This revision is starting in the autumn 2000.

2.4.4.1. Case A: Uncultivated forests

Based on this assumption, the data for calculating the resource rent may be found in the present Norwegian National Accounts. Two modifications have been done to the former National Accounts data. This comprises the production of services related to forestry, and imputation of compensation for labour of self-employed persons working in forestry.

In the National Accounts, we estimated the product "services related to forestry" in the period up to 1996. These services covered measurement of timber fellings, rafting of timber, and services of production planning and management. The production of these services ideally should belong to a separate industry 'services related to forestry,' and should not be considered part of production of forestry proper. We have suggested revisions of the National Accounts back to 1991 for production and intermediate consumption. Hence, we have separated the forest from the service activity. For other types of costs we have not prepared revisions yet, but we suspect these to be quite similar to what they are today.

Private individuals own most Norwegian forests and about 40 percent of those working in the forest industry are self-employed. Self-employed persons receive so-called 'mixed income.' Mixed income is

return to capital invested, and compensation for labour done by the self-employed persons. Assessing the resource rent, we need an estimate of the value of all labour done. The assumption is that compensation for labour done by a self-employed person working in forestry is the same as for an employed worker.

Based on these assumptions, and assuming 3.5 percent return to capital, the resource rent is calculated as in Table 6. The estimated rents show large year-to-year variations.

Table 6. Case A: 100 percent uncultivated forests. Forest resource rent. Mill. NOK

	1991	1992	1993	1994	1995	1996	1997
Output of forest industry							
according to national accounts (1)	4 320	3 883	3 469	3 267	4 266	3 466	3 626
Cost in the forest industry according to national accounts							
Intermediate consumption	1 219	1 231	1 124	1 191	1 165	1 106	1 200
+ Compensation to employees	751	840	742	693	717	636	631
+ Depreciation of capital	567	549	549	551	555	581	605
+ Normal (3.5%) return to capital	347	350	351	359	377	380	389
= Total costs (unadjusted) (2)	2 884	2 969	2 766	2 795	2 814	2 703	2 824
Difference (3) = (1) - (2)	1 436	914	703	473	1452	763	802
- adjustment for "compensation of employees" to include							
"compensation of self-employed persons in forestry"	483	504	514	495	512	451	463
Resource rent in forestry, incl. compensation							
to self-employed persons (1) - (3)	953	410	189	-22	940	312	339

2.4.4.2. Case B: 55 percent of forests areas are cultivated (resource rent calculations)

This case evaluates total growth of the forests at prices and unit costs that are consistent with those used in case A and in the national accounts. Then we apply the percentage of total growth that is assumed to be cultivated (86%) to this total.

Production includes the value of the growth of standing (cultivated) timber as well as the value of the timber fellings. The value of the growth of cultivated standing timber is regarded as change in inventory of work in progress. In this case, timber is a produced product, and mixed income/ net operating surplus is usually attributed in full to the use of labour/ capital utilised in the production process, with no part being interpreted as resource rent. In order to facilitate comparison with the uncultivated case A and previous calculations, we nevertheless calculate 'resource rent' in this case, using the formulas and concepts in an analogous way to the non-cultivated case. Our treatment as suggested for the national accounts is presented as case C.

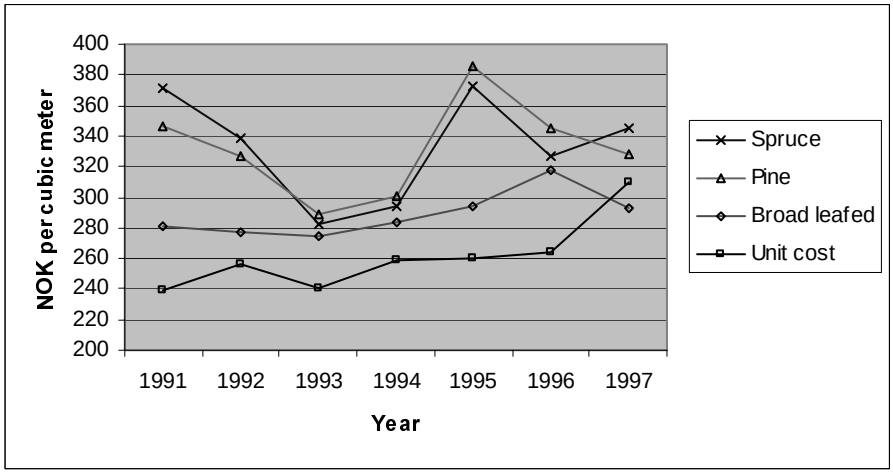
The data used for the national accounts is based on logging statistics, providing the number of m^3 roundwood cut according to assortment and tree species. Up to 1995, quantities cut in private and local government forests are reported by District Forestry Boards. Wood from common forests and State forests are reported by their respective management. The reports are collected by the forest administration in each county and forwarded to Statistics Norway. The reports contain detailed figures on assortment, species of tree, buyer group, and figures for average prices (from 1996 we have a new database from the Ministry of Agriculture for these data, which is entitled "Registry of Timber Trade and Diverted Forest Trust Fund"). Regrouping these data, average prices are calculated by three types

of trees, spruce, pine and broad-leafed trees. These three types match the information on physical growth of the forests. To do this regrouping, we have distributed cuttings of coniferous fuel wood for sale by species, assuming 20 percent pine, 80 percent spruce. The average prices do not fully reflect the different qualities and types of roundwood in the same degree as in the basic data from the National Accounts, but we do not have sufficient information on the physical growth by quality to use more details.

To calculate the resource rent, we need the unit cost of cutting 1 m^3 of roundwood and fuel wood for sale. This unit cost is calculated from the data in the national accounts. The part of total costs of forestry that are related to cutting of roundwood is assumed to be equal to the corresponding part of the production value. The products timber and firewood for own use, Christmas trees, reindeer moss and holly etc. (for decoration purposes), and investment work done in the forests are considered to be unrelated to cutting of roundwood and fuel wood for sale in this context. The same adjustment for compensation of labour of self-employed persons in forestry is applied as in case A

The resulting prices and unit costs can be seen in Figure 1. The prices have varied considerably during this period, whereas the unit costs show an increasing trend. Prices were low in 1993 and 1994. This corresponds to the low estimates of resource rents in those years. The unit costs entered include compensation for labour of self-employed persons in forestry.

Figure 1. Case B. Average roundwood prices and unit costs 1991-1997 NOK per m^3



The resultant calculation of resource rent in forestry is presented in Table 7. Case B gives estimates of forest rents that are higher in absolute value than those of case A. This is to be expected, considering that the volume of forest growth is more than twice the volume of roundwood cut during this period. The estimate of forest resource rent does not increase so much as the volume to be valued. The reason for this can be found in Tables 2 and 3, i.e. that the percentage of forest growth that are cut are much higher for the trees giving the best price (spruce and pine), than for broad leafed trees.

In Table 7 the results are based on a 3.5 percent rate of discount and rate of return to capital. As we have already mentioned, the forest growth is assumed to make it permissible to disregard the discounting of future income from forest growth of cultivated forests. Future growth for immature timber counteracts the discounting of the future incomes. In Table 8, however, is an example of the effects of a higher discount rate and return to (fixed) capital, using the value of 8 percent whereas the future forest growth remains at 3.5 percent on average.

To calculate the value of the work in progress we have used a stumpage price estimate of the standing timber. The stumpage price is calculated indirectly from data on market price of timber, costs of

felling, skidding to the roadside, and costs of transportation to the market. Transformed to unit costs these are lower than the "forestry total" unit cost derived from National Accounts data. This stumpage price estimate is then applied to the net growth of standing timber, calculated as total growth less roundwood cut, less natural growth etc.

In the case where the rate of discount is 8 percent, the work in progress is affected and becomes substantially lower.

In our example, the higher rate of return to fixed capital in the forest industry affects the figures in two ways: First, the higher capital costs gives a lower assessment of future incomes from the growth of cultivated timber. This gives a lower estimate of the production in forestry. Second, the resource rents for the forest industry are lower, as capital costs are higher. The effect on resource rents, disregarding discounting of future incomes, is dramatic. In this example, disregarding discounting is comparable to adhering to the low rate of discount that is supposed to be counteracted by forest growth.

The resource rent with discounted age classes is assuming a high rate of discount of 8 percent. With this high rate of discount it is no longer possible to omit the discounting of future income from immature forest. Assuming a growth period of 70 years in addition to the assumptions above, only 5 percent remains as a contribution to the net present value from the resource rent collected when the tree is mature (70 years from now). In this calculation we need to know the age distribution of the standing timber. We do not know this age distribution or any possible growth differentials between different age classes of trees. For the calculations in the example, we have assumed that 60 percent of the increment is ascribed to the youngest half of the forest. From this stage we divide the increment equally on the age classes and discount each class down to maturity, assuming an annual growth in the volume of timber of 3.5 percent.

Table 7. Case B. 55 percent cultivated forest area. Forest resource rent. Mill NOK. (3.5 percent rate of discount and normal return to capital)

		1991	1992	1993	1994	1995	1996	1997
Output of forest industry								
Estimated value of fellings	(1)	3 688	3 228	2 820	2 634	3 608	2 865	3 042
Income not related to production of timber	(2)	633	656	648	634	659	601	584
(1) + (2)		4 320	3 883	3 469	3 267	4 266	3 466	3 626
Work in progress	(3)	994	1 079	931	1 081	1 486	1 655	1 510
Estimated value of production	(1)+(2)+(3)= (4)	5 314	4 962	4 400	4 348	5 752	5 121	5 136
Cost of forest industry								
+Intermediate consumption		1 219	1 231	1 124	1 191	1 165	1 106	1 200
+Compensation of employees		751	840	742	693	717	636	631
+Consumption of fixed capital		567	549	549	551	555	581	605
+ Normal return to capital (3.5%)		347	350	351	359	377	380	389
- cost of producing services related to forestry		89	104	104	101	110	99	-
=Total costs	(5)	2 795	2 865	2 662	2 694	2 704	2 604	2 824
Difference	(4) - (5)	2 519	2 097	1 738	1 655	3 048	2 517	2 312
- comp. of self employed persons		483	504	514	495	512	451	463
=Resource rent in forestry, incl. compensation to self-employed persons		2 036	1 593	1 224	1 160	2 536	2 066	1 849

Table 8. Case B 55 percent cultivated forest area. Forest resource rent. Mill NOK. (8 percent rate of discount and normal return to capital)

Output of forest industry		1991	1992	1993	1994	1995	1996	1997
Estimated value of fellings	(1)	3 688	3 228	2 820	2 634	3 608	2 865	3 042
Income not related to production of timber	(2)	633	656	648	634	659	601	584
(1) + (2)		4 320	3 883	3 469	3 267	4 266	3 466	3 626
Work in progress	(3)	262	284	245	285	392	436	398
Estimated value of production (1)+(2)+(3)=	(4)	4 582	4 167	3 714	3 552	4 658	3 902	4 024
Cost of forest industry								
+Intermediate consumption		1 219	1 231	1 124	1 191	1 165	1 106	1 200
+Compensation of employees		751	840	742	693	717	636	631
+Consumption of fixed capital		567	549	549	551	555	581	605
+ Normal return to capital (8%)		773	793	799	802	821	863	870
- cost of producing services related to forestry		89	104	104	101	110	99	-
=Total costs	(5)	3 221	3 309	3 110	3 136	3 148	3 086	3 306
Difference (4) - (5)		1 362	859	1 007	765	1 777	982	904
- compensation of self employed persons		483	504	514	495	512	451	463
= Resource rent in forestry, incl. compensation to self-employed persons		879	355	493	270	1 265	530	441

2.4.4.3. Case C. 55 percent of the forest is cultivated (national accounts calculations)

This case uses the same assumption as case B. As a consequence of the fact that no logging is assumed to take place from uncultivated forests, timber is a produced product, and no resource rent is defined from timber production. This case then displays the National Accounting entries for the forest industry that are proposed for the revised National Accounts.

In case C we look at the forest industry in terms of national accounts measures. However, the approach is taking into account that increment in forest is a measure of production. The prices of timber is of course the same as in case B, but the structure of the cost has been adjusted according to the concepts we are focusing on.

The valuation of work in progress is equal to the results shown in case B (table 7), while costs and other components of production are comparable to case 6. In this case we derive value added and operating surplus/ mixed income. Value added and operating surplus are national accounts concepts, and we are not deriving a forest wealth estimate based on these.

Table 9. Case C 55 percent of area and 86 percent of increment is cultivated forest

		1991	1992	1993	1994	1995	1996	1997
Output of forest industry								
Estimated value of fellings	(1)	3 688	3 228	2 820	2 634	3 608	2 865	3 042
Income not related to production of timber	(2)	633	656	648	634	659	601	584
(1) + (2)		4 320	3 883	3 469	3 267	4 266	3 466	3 626
Work in progress	(3)	994	1 079	931	1 081	1 486	1 655	1 510
Estimated value of production (1)+(2)+(3)=	(4)	5 314	4 962	4 400	4 348	5 752	5 121	5 136
Cost of forest industry								
Intermediate consumption	(5)	1 219	1 231	1 124	1 191	1 165	1 106	1 200
Compensation of employees	(6)	751	840	742	693	717	636	631
Consumption of fixed capital	(7)	567	549	549	551	555	581	605
Other taxes and subsidies on production (net)	(8)	-67	-70	-85	-121	-111	-106	-132
Value added (4) - (5)		4 095	3 731	3 276	3 157	4 587	4 015	3 936
Gross operating surplus/ mixed income (4)-(5)-(6)-(8)		3 411	2 961	2 619	2 585	3 981	3 485	3 437
Net operating surplus/ mixed income (4)-(5)-(6)-(7)-(8)		2 844	2 412	2 070	2 034	3 426	2 904	2 832

2.4.5 Forest wealth

Based on the calculations for the resource rent, the next step is to calculate forest wealth. The forest wealth is calculated according to case A and case B.

There is substantial year-to-year variation for each of the cases. This appears to be a result of the large variations in roundwood prices during the period. The variation should be reflected in the resource rents, describing an important feature of the forest industry. To estimate forest wealth, however, we need estimates of future rents. We have discussed using a 5-year moving average in this part of the calculation to smooth out some of the variation in prices for each year. This is something we need to discuss further when a longer time series of data are available.

The choice of discount rate is important regarding the resource wealth. In the discussion about the "proper" rate it has been proposed rates from 1.5 percent to 8 percent, depending on the forum in which the discussion takes place. SNA93 does, as we have already mentioned, recommend a rate derived on a basis of the transactions in the particular type of assets under consideration; In this case, the forest (§ 13.34).

When we have a natural regeneration of the forest, it is possible to run a pure harvesting forestry. The wood is capitalising through growth. The increment is added continuously, and the stock is growing. Young forest is growing fast, but as the forest gets older, the growth is stagnating. Still, the forest owner will choose the time to harvest, based on his reflections about growth in value, and the required harvesting point. Due to the biological processes, though, there is no forest population in Norway that is able to give an interest on 8 percent on the standing forest capital. Using a discount rate of 8 percent for marginal investments in the forest, the management as it appears today will most probably be unprofitable, and cultivation activities will stop.

This brings us to a discussion on what the social rate of discount should be. Officially a 3.5 percent rate is recommended for cost-benefit analyses (NOU, 1997) in situation containing no risk. Of course there are activities with higher return than this rate. Still, in a social economic perspective all the

capital can not be used on these alternatives without reducing the marginal return simultaneously. This rate of 3.5 percent, which contains no element of risk, is actually relatively high, and indicate that one should be careful with substantial investments in regeneration. The line of reasoning here is that the optimal regeneration effort, from a social point of view, depends on the social rent.

To be rational the forest owner must run his business (the forest) so the marginal return (after tax) is equal to the most profitable alternative business (after tax), and of course, include risk in the calculations. We consider three different state of affairs: (1) the marginal return is equal to the social rate of calculation, (2) the marginal return is less than the social rate of calculation, and (3) the marginal rate of return is greater than the social rate of calculation. The first situation will not entail any problems. There will be accordance between what is optimal for the private forest owner and the society. The second situation will lead to more regeneration in the forest. This means that more resources are used for this purpose than what is seen as optimal for the society. This also means that a reduction in regeneration will create a social benefit. The third condition will lead to less investment in the forest than what is seen as socially optimal. In the latter situation it may be sound to change the forest policy to increase investments in the forest (e.g. the Forest Trust Fund). There is substantial agreement among specialists in the forestry field in Norway today that situation (2) is prevailing. The felling and investment in the private forestry of today indicate a real interest (after tax) of 2 percent (Norsk Skogbruk, 2000, vol.1).

The Norwegian forests have an average value growth of 2-3 percent. Approximately 100 000 forest owners have adapted the time of felling to this level. This may be a good indication of the level of the discount rate.

Likewise, the method for discounting future resource rents is described in the forestry section of the final 1998 NOREEA-report (Hass and Sørensen 1998) and concerning oil and natural gas resources. Forests are a renewable resource and are supposed to be sustainable forever. This implies that the equation for calculating forest wealth becomes:

$$FW_t = FR_t / r$$

FW is forest wealth
FR is the forest resource rent
r is the discount rate.

The discount rate used is 3.5 percent (Table 10). We also provide an alternative to show the influence of higher rate of return to capital and a higher discount factor (both equal to 8 percent in Table 11.

Table 10. Estimated resource rent and forest wealth of Norwegian forests. Million NOK. Discount rate 3.5 percent

Year	**Resource rent**	
	Case A All forest cultivated	Case B 55 percent cultivated forest area
1991	953	2 036
1992	410	1 593
1993	189	1 224
1994	-22	1 160
1995	940	2 536
1996	312	2 066
1997	339	1 849
	Forest wealth	
1991	27 241	58 183
1992	11 722	45 515
1993	5 390	34 967
1994	-630	33 145
1995	26 860	72 447
1996	8 925	59 022
1997	9 681	52 839

Table 11. Estimated resource rent and forest wealth of Norwegian forests. Million NOK. Discount rate 8 percent

Year	Resource rent	
	Case A All forest cultivated	Case B 55 percent cultivated forest area
1991	528	879
1992	-33	355
1993	-259	493
1994	-465	270
1995	496	1 265
1996	-170	530
1997	-143	441
	Forest wealth	
1991	6 597	10 988
1992	-418	4 437
1993	-3 242	6 168
1994	-5 812	3 374
1995	6 201	15 807
1996	-2 121	6 630
1997	-1 781	5 517

The Norwegian Ministry of Finance (NOU 1997:22) suggests that 3.5 percent is used as the discount rate on projects that have little or no risk, whereas a discount rate of 8 percent should be used for projects having "normal" risk. As for the rate of return to capital, the high alternative (8 percent) seems to be high relative to the observed rates of return in agriculture and forestry. Both estimates of forest wealth are based on calculations of resource rents including compensation for labour of self-employed persons working in forestry. The pattern of variation is the same for the wealth estimates as for the estimates of resource rents.

When we look at the estimation of resource rent and forest wealth, we see that small adjustments in the uncertain assumptions may create quite substantial differences in the results. It may be wise to bear this in mind when conclusions are drawn upon these results. The trends, however, seems to be less ambiguous.

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3. Extensions to the Norwegian NAMEA

The Norwegian NAMEA for air emissions was first developed in 1997 and 1998. This information has been refined, revised and updated since that first publication. The time series now extends from 1991 to 1997 and was expanded to include air emissions for 23 different emission types, plus value-added, energy use and employment. This information is available at the NACE division (two-digit) level of detail. Additional detail is available for some NACE groups and classes. These newly updated tables are included as an annex to this report. Appendix Table A.1 provides a description of NACE codes.

The NAMEA system is now being expanded to include a number of solid waste fractions and types of emissions to water. This is the major work that is being presented for the first time in this report. Only trial calculations are presented in this report since additional data revision and co-ordination are required before these data can be used with confidence.

We are finding that interest in sector-based environment-economic information is increasing now that we have this type of information available for air emissions. The Ministry of the Environment (MD) has encouraged the use of NAMEA-based data due to its recent requirement that each of the different government ministries develop an environment plan for reaching the newly established national environmental goals. As a part of the environment plan, each ministry needed to develop a current environmental profile for the sector for which it has responsibility and provide information regarding the environmental measures that are to be taken. MD established a special project for describing the environmental profiles for a selected number of manufacturing and service industries. The NAMEA air emissions data were used as a major source of information for this project.

4. NAMEA: Solid waste

Solid waste and recycling are national environmental focus areas (White Paper no. 8, 1999-2000). The Ministry of the Environment is developing a set of national goals with corresponding indicators to measure the progress towards the goals. Information relating to the national environmental goals and indicators are to be reported annually by each of the different Ministries to the Ministry of the Environment. There is a national environmental reporting system being developed by the Norwegian Pollution Control Authority with assistance from Statistics Norway. It is expected that NAMEA-based work will contribute data to this national reporting system. Since the Ministry of the Environment has required that each Ministry develop an environmental strategy plan for following up the national environmental goals, sector based environmental information will become very important in the future. Solid waste is having a higher priority in Norway than water use and water emissions. For these reasons the NAMEA for solid waste has been able to progress farther and will probably be a better area for focus in the near future.

The solid waste statistics for Norway are under constant development. Statistics Norway was given the responsibility for co-ordinating information concerning all solid waste in Norway by the Norwegian Pollution Control Authority. Currently there are some overlapping and missing areas in the current set of information. These problems are being addressed by the different agencies responsible for the differing types of solid waste information. Statistics Norway is responsible for developing waste accounts that include estimates for total amounts of solid waste generated in Norway. These accounts are being developed based on two methods, traditional survey based information using sorting analyses and a "supply of goods" method using production, import and export statistics together with content and lifetime estimates. The supply of goods method was developed in the mid-1990s and the waste accounts continue to be expanded based on this methodology in terms of the types or fractions of waste. We have chosen only certain fractions for closer examination. The fractions selected for this project are plastic, glass, wood and paper. Fractions that are currently under revision and development are wet organic waste and metal waste.

4.1 Two methods for estimating solid waste amounts

Statistics Norway uses two methods for estimating solid waste amounts for the different solid waste fractions. One method uses only data from a variety of solid waste surveys as the basis for calculating estimates. This method is called the "waste statistics method." The other approach uses production, import and export statistics together with content and lifetime estimates to calculate amounts of solid waste generated based on production and supply of goods. This method is called the "supply of goods method."

The **waste statistics method** uses existing statistics for the material of interest, for example, plastic, glass, wood, paper, etc. Unfortunately the existing statistics are not sufficient to obtain an overall picture. Once all of the available statistics are compiled the gaps are filled in using a variety of estimation techniques; e.g. extrapolation and interpolation for missing years and the use of auxiliary variables such as employment and value of gross production.

The **supply of goods method** is based on the assumption that every new product supplied to society will end up as waste after a certain period of time. The method has four major steps.

- **Step One:** Involves the calculation of the supply of the material of interest (for example, plastic, glass, wood, paper, etc.) in goods based on Statistics Norway's external trade statistics and manufacturing statistics according to the following relationship:
  Supply of goods = primary production + imports - exports + net stock change (if available)

- **Step Two:** Involves the calculation of the supply of the material of interest (for example, plastic, glass, wood, paper, etc.) by multiplying the weight of the products by their percentage content of the material of interest according to the following relationship:
  Supply of material "a" = supply of goods * content of material "a" in percent / 100

- **Step Three:** Involves the estimation of the annual waste generated as determined by the lifetime intervals of the different products. It is assumed that equal amounts of a product are discarded each year during the product lifetime (a rolling average approach). The following relationship shows this calculation:
  Product waste generation = supply of material "a" / (maximum lifetime - minimum lifetime)

To avoid double counting, only end-use products are included.

- **Step Four:** Involves making a summation of all the product waste in a specific year in order to obatin the total amount of a specific type of waste material for that particular year.

In the years when a specific survey has been conducted, the same estimates are used in both methods. For example, when the survey of the manufacturing industry is conducted, these statistics are used in the waste statistics calculations and also in the supply of goods method for allocating waste amounts to the industry categories. For years when there is no survey providing detailed data then only estimates for NACE D are made.

Interestingly, the supply of goods method tends to give higher estimates than those based on the survey method. This is true for three of the four fractions examined here, the exception is wood. The difference between the results of these two methods also tends to decrease over time. The results from each method are evaluated with respect to reliability. For the four fractions examined in this report, the supply of goods method is regarded as being the more reliable. However for the fractions metals and wet-organic materials that are under current development and are not considered in this report, the waste statistics method is considered to be the more reliable.

4.2 Trial NAMEA-matrices for different fractions

4.2.1 Main results and discussion

In the NAMEA-matrix it is desirable to have information at a high level of detail. In the Norwegian air emissions NAMEA-matrix the data are available broken down according to over 60 industry (NACE rev. 1) categories. From these trial calculations we found that unfortunately the detail available for waste statistics is much less and the industry groupings also vary according to solid waste fraction.

The trial matrix set-up for the environment data part of the NAMEA is presented for 1996 in the following table. This year was chosen since this is the first year that the survey for the manufacturing industry used NACE rev. 1 definitions. Following this table, each fraction is described and a figure showing a time series of data is provided for the totals for each fraction according to the two different estimation methods, if available.

The figures presented are totals for the NACE category. Originally it was thought that both total amounts and amounts according to treatment methods could be obtained for each NACE category. This was proposed in the early version of the supply of goods method (Skogesal 1997, Table 13) but has only been published for wet-organic waste (Skullerud 1998). For the other fractions, the amounts estimated by treatment method are only for the total amounts for the whole country and not broken down into detailed NACE categories. In order for treatment amounts to be obtained from the survey of the manufacturing industry it would be necessary to increase the number of units needed to be included in the survey to get this additional detail. At this time it is not feasible to consider increasing the coverage of this survey primarily due to the increase in costs this additional requirement would cause. It is now doubtful that this detail will become available in the future. Some treatment estimates are planned when the supply of goods calculations for the various waste fractions are revised but it is still uncertain the detail that will become available. It is very doubtful that reliable figures will be possible across all three dimensions, NACE code, handling method and type of waste. Data is available for combinations of two of these variables but not all three.

There was a new survey in the manufacturing industry (NACE D) made in 1999. The results are not yet available however the detail that will be available from this survey will be greater than in 1996. It is planned that at least for some industries it will be possible to estimate waste amounts across all three dimensions, NACE code at the sub-section level (2-letters), handling method and type of waste. For a number of sub-sections it is also planned to have detail at the group level (3-numbers) at least for total waste and handling method.

At this time only the totals for waste arising within Norway are presented. Information regarding waste amounts imported or exported was examined. The supply of goods method does include a calculation of exports in Step One of the calculation methodology but this amount is not "waste" exported but "goods" exported. For the plastic waste fraction there are estimates for the different final treatments of solid waste that include an estimate for a treatment category "exported." This value is presented in the last row of the table. In 1996, there was 363 673 tons of plastic waste generated in Norway, of which 9 336 tons of plastic waste were exported. There are no estimates of exports available for the other fractions. This information is possible to estimate based on external trade statistics. In many cases fractions are exported for recycling and these amounts are included in the statistics under the category "recycling."

Imports of solid waste for the fractions examined did not appear in any of the estimates. The only "imports" included in the calculations in Step 1 of the supply of goods method, are related to "goods" and not waste. These imports are considered imports of goods not import of waste. Imports of waste are not included in the solid waste accounts.

A time series of data are presented in figures for each of the four fractions. These show the estimates for total amount of waste according to the two methodologies. The supply of goods method provides estimates of "generated waste" and the waste statistics method provides estimates of "disposed waste."

Table 12. Solid waste according to fractions and NACE

1996			Plastic		Glass		Wood		Paper	
			Supply of Goods method	Waste statistics	Supply of Goods method	Waste statistics	Supply of Goods method	Waste statistics	Supply of Goods method	Waste statistics
TOTAL			**363 673**	**311 216**	**141 537**	..	**1 144 200**	**1 036 343**	**920 827**	**977 567**
Other sectors (A, B, C, E)			9 917	8 239	26 322	..	620	620	28 363	..
	A	Agriculture, hunting and forestry	6 123	5 087	..	..		0		4 437
	B	Fishing	3 403	2 827	..	..		0		..
	C	Mining and quarrying	253	210	..	..		401		3 325
	E	Electricity, gas and water supply	138	115	..	..		219		1 820
Manufacturing (NACE D)			53 798	53 797	19 223	19 226	790 797	790 797	163 202	173 258
	DA (15, 16)	Food products; beverages and tobacco	15 875	15 875	..	12 434		6 398		29 750
	DB (17, 18)	Textiles and textile products	775	775	..	5		879		1 604
	DC (19, 20)	Leather and leather products	164	164	..	0		47		94
	DD (20)	Wood and wood products	6 606	6 606	..	900		592 871		3 036
	DE (21, 22)	Pulp, paper & paper products; publishing and printing	10 277	10 277	..	54		152 173		99 775
	DF (23)	Coke, refined petroleum products & nuclear fuel	174	174	..	71		277		373
	DG (24)	Chemicals and chemical products	2 145	2 145	..	286		3 971		4 450
	DH (25)	Rubber and plastic products	9 239	9 239	..	18		1 116		2 547
	DI (26)	Other non-metallic mineral products	487	487	..	5 146		1 555		1 325
	DJ (27, 28)	Basic metals and fabricated metal products	1 151	1 151	..	123		5 241		5 600
	DK (29)	Machinery and equipment n.e.c.	877	877	..	86		2 463		4 359
	DL (30, 31, 32, 33)	Electrical and opitcal equipment	2 470	2 470	..	31		2 216		5 677
	DM (34, 35)	Transport equipment	1 257	1 257	..	64		3 346		7 537
	DN (36, 37)	Manufacturing n.e.c.	2 300	2 300	..	8		18 245		7 129
Building and construction (NACE F)			7 634	6 342	42 875	..	208 748	208 748	incl. in "other"	20 529
Service (NACE G to O, Q)			105 262	87 443	incl. in "other"	..	46 490	12 237	262 191	278 347
Not able to distribute to NACE										53 388
Households (incl. NACE P)			187 062	155 395	53 117	44 541	97 545	23 941	467 071	442 463
Amount of total waste exported			9 336	..	..	..	..	..	..	..
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

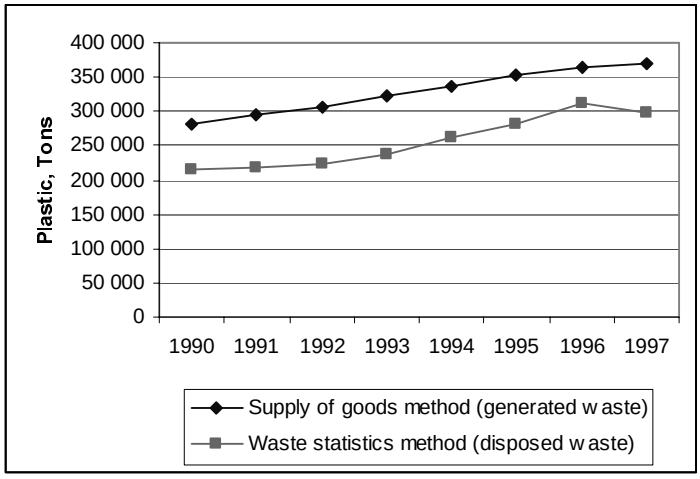
(1) Report 2000/15 Table 4.3
(2) Report 2000/15 Table 4.1 for total, (details in file: siv\220\avfall\5 regnskap\Bygging\plast\afmetode.xls sheet: avfallstat.metode)
(3) http://www.ssb.no/emner/01/05/40/avfregnglass/tab-2000-05-29-03.html
(4) http://www.ssb.no/us/utg/9807/9-5t.txt
(5) Report 2000/12 Table 5.1
(6) file: siv\220\avfall\5 regnskap\tre\Tre Avfallsmetode.xls sheet: avfallstat.metode, industri stats - uken statistikk
(7) http://www.ssb.no/ukens_statistikk/utg/9904/3-3t.txt
(8) Table 9 file papir99.xls sheet "til US"

4.2.2 Plastic

The 1996 statistics for plastic are the most detailed available of the four different fractions examined. These are also the most recent calculations (Skullerud and Stave 2000). There are estimates for NACE sections A, B, C, E, F. There are also estimates for manufacturing at the subsection level, DA through DN inclusive, based on the 1996 survey of the manufacturing industry. The final two groups are "Services" that include NACE G to O, Q and "Households". Estimates for Section D: Manufacturing at the subsection level are only made for the years that the Industrial Waste Survey is conducted. For the other years only a total value for the entire section is estimated and not values for the subsections.

The following figure provides a time series of data for total plastic waste in Norway according to the two estimation methods. The supply of goods method provides estimates that are approximately 25 percent higher than the waste statistics method for 1990-1994. In the last three years this difference is less ranging from 14 to 20 percent. It would appear that the waste statistics are including more of the expected waste production of plastic.

Figure 2. Total generated and disposed plastic waste, tons. 1990 - 1997



(Skullerud and Stave, Report 2000/15, Table 4.1)

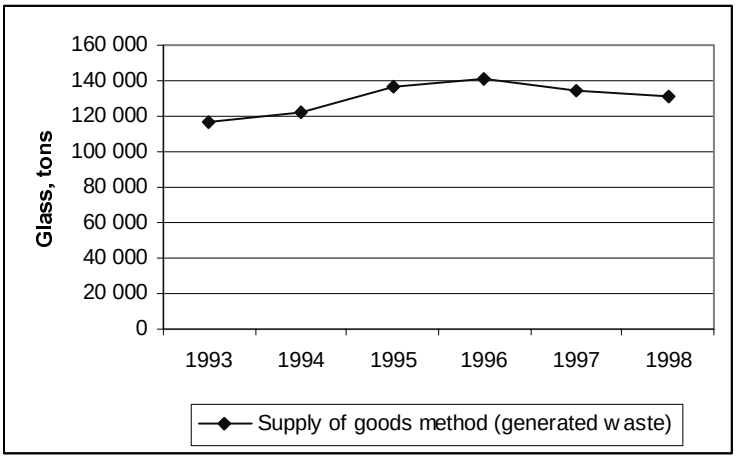
NACE G to O, Q includes a wide variety of activities including wholesale and retail trade, hotels and restaurants, health and social work, public administration. The waste amounts for this category are the second highest. Only households have higher figures for plastic waste. It would be advantageous to have the "service" category (NACE G to O, Q) split up into more detail. Unfortunately this is not possible using the current survey, estimation and allocation methods.

In the table an estimate of plastic waste exported is included. This is the only fraction for which an estimate for "exports" has been made.

4.2.3 Glass

Glass, on the other hand, has the least detail according to NACE groups and there are only estimates based on the supply of goods method. This fraction was one of the first to be estimated using the supply of goods method (Skogesal 1997). There are only figures for four NACE categories. These categories are (1) A, B, C, E, G to O, Q (2) D: Manufacturing (3) F: Building and construction, and (4) Households. The figures for Section D: Manufacturing can be broken down into more detail (subsection level) based on the manufacturing industry waste survey for the years that this survey is conducted. The Section D figures used in the supply of goods calculation method are basically the same as those reported in the industry statistics. The difference of three tons is due to rounding. The high level of aggregation for this fraction does not allow for much further analysis or detailed use of the data. Only households and manufacturing (D) could be examined in more detail.

Figure 3. Total generated glass waste, tons. 1993 - 1998



(Statistics Norway, http://www.ssb.no/emner/01/05/40/avfregnglass/tab-2000-05-29-03.html)

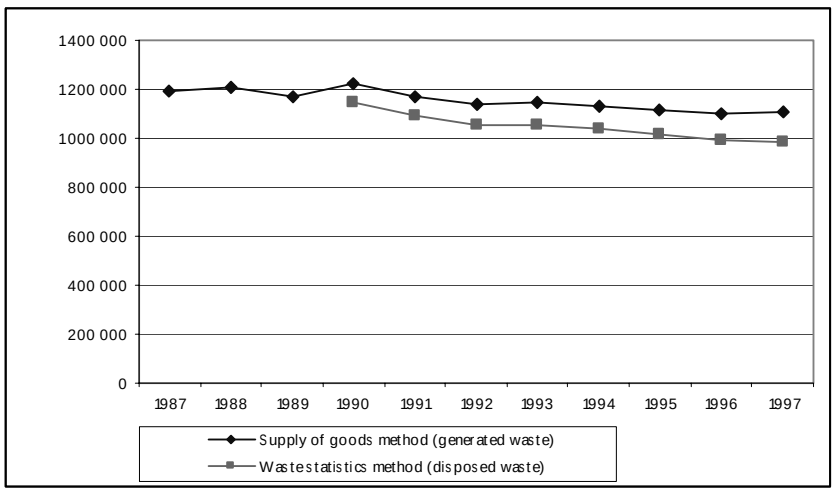
There is product category for "broken glass" in the external trade statistics (HS product number 70010000). There are figures available for imports and exports of this product group that could be used as estimates for net imports (or net exports). But there is a question of the value of these imports and whether these should be considered as import/export of waste (if there is no monetary value) or import/export of goods, raw materials or unfinished goods.

4.2.4 Wood

The distribution of amounts of waste generated using the supply of goods estimates for wood for 1996 are based largely on the waste statistics data. The same values are used not only for NACE D but also for "Other sectors" (NACE A, B, C, E) and for NACE F Building and construction. The differences between the two methods are distributed only between Households and "Services" (NACE G to O, Q).

Treatment of wood waste is estimated for 1996 according to four categories: material recycling, incineration, landfilled, and other. There was no estimate for wood waste "exports". This category could be a part of the "other" category, which in 1996 included only 1 percent of wood waste and could therefore, be assumed that there are negligible amounts of wood waste exported. On the other hand some waste exports may be exported for recycling and are included in the values for "recycling."

Figure 4. Total generated and disposed wood waste, tons. 1987 - 1997



(Frøyen and Skullerud, Report 2000/12, Figure 5.1)

The difference between the waste statistics method and the supply of goods method increases from approximately 6 percent in 1990 to over 10 percent in 1997. This is most likely explained by the increase in the waste from furniture. There has been a 47 percent increase over the seven-year period 1990 to 1997.

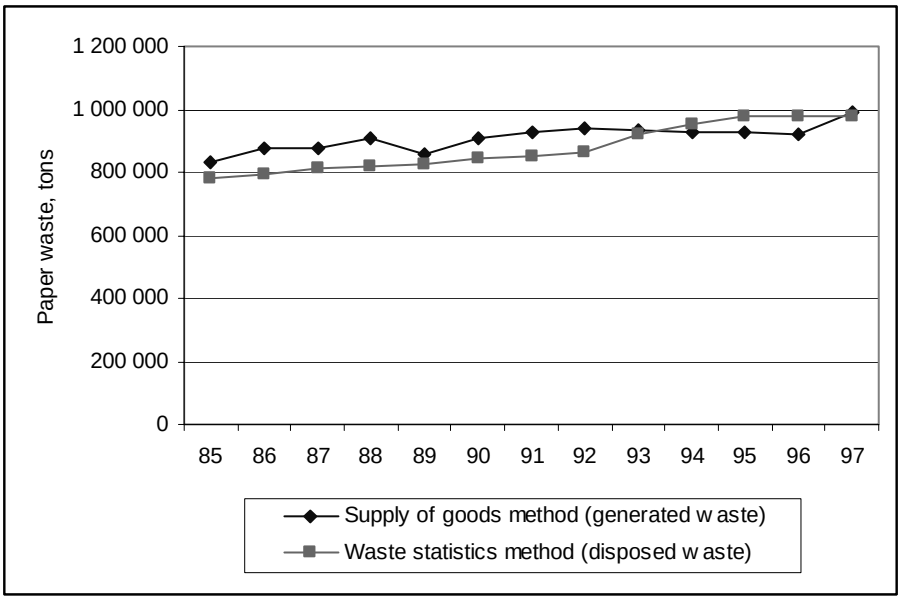
4.2.5 Paper

From 1994 to 1997 disposed paper waste was greater than the estimated generated paper waste. Of the four fractions examined, this is the only time period that the waste statistics estimates are higher than the estimates from the supply of goods method. Part of the assumptions behind the supply of goods method of calculation is the concept of "stock." It is assumed that the stock of the fraction is constant over time. In the time period 1994 - 1997, it appears that this is not the case for paper since the estimates of generated waste are less than the estimates for disposed waste. During this time period it appears that the stock of paper is reduced. Another possible explanation is that the percentage of paper in household waste is over-estimated based on the sorting analyses used for making these calculations.

The supply of goods method provides only estimates for four NACE categories. These categories are (1) A, B, C, E, F (2) D: Manufacturing (3) G to O, Q: Service, and (4) Households. The waste statistics method includes estimates for NACE A, C, D (at the subsection level), E, F, G to O + Q, and Households. There is no estimate for B: Fishing but there is an estimate for the total amount. There is also an amount (53 388 tons) that has not been assigned according to NACE.

The estimates according to type of treatment do not include imports or exports as categories. There is a category "other types of treatment" that represents approximately 4 percent of the total however this does not include imports.

Figure 5. Total generated and disposed paper waste, tons. 1985 - 1997



(Statistics Norway: http://www.ssb.no/ukens_statistikk/utg/9904/3-4t.txt)

4.2.6 Other fractions

The supply of goods method will be applied to other waste fractions in the future. Current waste accounts are being developed and revised for (1) wet-organic waste, (2) metal waste, (3) textiles, and (4) concrete, asphalt and brick.

The survey covering the manufacturing industry in 1996 included the following types of waste fractions: paper, plastic, glass, iron and metal, textiles, wood, gardening waste, wet-organic (food, slaughterhouse and fish waste), automobile tires, rubber excluding tires, asphalt, ash, dust, sludge,

cinders, chemicals, other, unsorted/unknown and hazardous waste. The survey in 1999 also includes these fractions. The 1999 survey is expected to provide better estimates since the sample of enterprises included in the survey was larger than in 1996. And the selection methodology and criteria were different which will allow for making more detailed estimates.

The municipal waste survey included the following types of waste fractions: paper, cardboard and drink containers, glass, plastic, metal, wet-organic, wood, garden waste, textiles, other, and unsorted waste. Since these surveys include these different types of waste fractions it is easier to develop estimates at more detailed NACE groupings.

4.3 Conclusions and next steps

From examining table of results presented for the four waste fractions, plastic, glass, wood and paper, there does not appear to be a consistent set of NACE groups for which all of the different estimates are available. The estimates for glass and paper cause the most problems since "Services" (NACE G to O, Q) are included in "other sectors" for the glass waste fraction whereas NACE F (Building and construction) is included in "other sectors" for the paper waste fraction.

The calculations for plastic are the most recently completed and these show the most detail. NACE sections A, B, C, E, F and households all have estimates. Section D: Manufacturing has data available at the subsection level. The major weakness is the category "service" that includes NACE sections G to O, P. This is a very large grouping. Obtaining more detail for these sections could be a focus for the future. The plastic waste estimates are an improvement compared to those for glass and paper however the plastic waste estimates still have much less detail than the NAMEA-air emissions matrices. Additional detail could be desirable for the category "service."

This current weakness in the waste statistics needs to be addressed. Since the waste accounts are rather new, full consistency in the accounts has not yet been achieved. For some types of waste fractions certain industries are more important than for other fractions. For this reason the different fractions have had different NACE groups included at different levels of detail. The inconsistencies in the detail of the NACE groups arose primarily because the accounts have been developed with the first focus on the waste type or fraction and not on the NACE groups. It will require some additional work to obtain consistent NACE groups for all fractions but this should theoretically be possible based on the way that the accounts and calculations are set up. Now that this problem has been identified, it is expected that the accounts for new waste fractions will be developed with more consistent NACE groups and that when the established fractions are revised that they will be revised with more consistent NACE groups.

Estimates for import and export of waste also need to be considered in greater detail and separated out from other categories such as "recycling". For some waste fractions imports and exports are not a significant part of the waste treatment streams. But for some fractions imports and exports can be an important part. One issue that must be considered, however, is that the waste may not be considered "waste" but as a "good." There are differing opinions concerning when the transition from "goods" to "waste" takes place. When setting up the NAMEA matrix and imports and exports need to be included, this goods/waste issue will need to be resolved. At this point "import" of waste has not been included in the waste accounts. This situation needs to be investigated further and again it is expected that the waste/goods issue will arise. One example may be related to automobiles imported from Germany. Some of the used cars imported to Norway are defined as "waste" in Germany but are sold as "goods" (used cars) here in Norway. If NAMEA data are compared internationally the imported/exported waste may not make sense due to this waste/goods definition problem.

The next steps for this work include developing a time series of data for each fraction at the most detailed level as possible including estimates for the different treatments of waste. The detail of the

NACE groupings can vary from year to year so this will make the system more complicated than the NAMEA-air emissions tables. Additional fractions, for example, wet-organic waste and metal waste need to also be included. This work needs to be co-ordinated with the group responsible for developing and updating the solid waste accounts at Statistics Norway.

The solid waste directive from the EU (Eurostat) is also expected to require changes in the Norwegian solid waste statistics. However, until that directive is passed and requiring implementation it is difficult to fully anticipate the changes that will be required.

4.4 References

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5. NAMEA: Emissions to water

5.1.1 Data quality considerations

The work here has focused on two different areas, emissions of a number of heavy metals that are considered to be toxic substances and emissions of nitrogen and phosphorus. The information that is available for these various emission types is taken primarily from the INKOSYS administrative register from the Norwegian Pollution Control Authority (SFT). The information found in this database includes all discharge licences issued by SFT and the required reporting connected to these licences. There is no information regarding companies that do not have licences and have emissions that are under the legal permit level. There is also no information for companies that should have obtained licences but have not applied.

The data found in this database will be made available to the public on SFT's Internet website by the end of 2000. SFT is in the process of revising the data that is currently found in the database before these are placed on the website. The revision process involves sending the current data to each company and asking them to review the values before the figures are made public. If the figures need to be changed the company needs to provide a reason for this revision since the company is legally responsible for its emissions and for the reporting. Unfortunately this revision process has not yet been completed so we have had to use the emission values currently in the database. The data for air emissions will be released on the Internet first. The emissions to water data will take additional time before they are released. The tables presented here are only to be considered very rough estimates that need to be examined in more detail before wider use is made of the data. Once SFT has completed its revision process it will be possible to obtain better information relatively easily based on the experience we have gained through this pilot project.

One major difference between air emissions and emissions to water is the problem of double counting that is encountered due to the flow of wastewater to wastewater treatment plants. If a company emits a certain amount of effluent to the wastewater system and this waste then flows to a wastewater

treatment plant the emissions can be counted twice. Once when the company emits and again when the sludge content and/or emissions are measured coming from the wastewater treatment plant. This is particularly a problem for types of emissions that are highly soluble in water, such as nitrogen and phosphorus. The risk of double counting is less of a problem for heavy metals that are often emitted directly into a recipient waterway that largely retains the substance near to the point of emission. Heavy metals have the greatest effect on the ecosystems near where the emissions occur. Therefore the best place to measure the emissions is at the point where the emissions occur. Until there is a more complete accounting system developed for water that takes into account the flows of water and the problem of double counting it is not going to be easy to come too much further in the development of the Norwegian NAMEA for water.

5.2 Emissions of heavy metals to water

5.2.1 Introduction

In developing emission tables for heavy metals to water it is assumed that the emissions of heavy metals primarily affect the local recipient environment and not to travel too far from the emission source. In other words, that these toxic substances are primarily retained in the local environment. This may or may not be a valid assumption and depends very much on the substance itself.

We have chosen to focus on the heavy metals that are listed in the INKOSYS administrative database from the Norwegian Pollution Control Authority (SFT). The information contained in this database is from enterprises that have a discharge licence for a particular type of emission. New substances are added to the database when there is a change in the list of substances that require discharge licences. Since this is an administrative register there is no attempt to calculate emissions for previous years or before an enterprise is required to obtain a discharge licence. The data quality and breadth of information available is improving in the more resent years. SFT has started reporting these types of emissions to the Eurostat / OECD Joint Questionnaire for Inland Waters (Table 7) beginning from 1997 based on data found in their INKOSYS database.

We have used INKOSYS data from 1995, 1996 and 1997 for this pilot project. As mentioned earlier, these data are very preliminary and will be subject to revision once SFT is finished with its revision process of the database. There are approximately 65 different types of discharge licences listed in the database. This number changes with time due to new regulations.

19 heavy metals have been chosen for closer examination for several reasons. First, a number of these heavy metals are toxic substances that the Ministry of the Environment has stated in the White Paper No. 58 (1996-1997) to the Parliament that emissions of these substances are to be substantially reduced by the year 2010. Included in this list are cadmium (Cd), copper (Cu), mercury (Hg), and lead (Pb). Identifying emission trends for these toxic substances are needed in order to determine if these goals set by the Ministry of the Environment have been reached.

There are also a number of these substances that are being requested for reporting to the Eurostat / OECD Joint Questionnaire for Inland Waters (Table 7). The substances requested are: arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), lead (Pb), nickel (Ni), and zinc (Zn). The examination of the data used as a basis for this reporting can also increase the quality and amount of data reported to Eurostat/OECD.

Three years of data have been examined. Examining three years of data helps to identify if the reporting of emissions levels is about the same over this time period and if there is usually reporting for that emission type from a certain NACE category. Identifying discrepancies is more easily accomplished with three years of data to compare. We have also compared the 1997 data with the values SFT has reported to the Eurostat/OECD Joint Questionnaire 2000.

In addition to the INKOSYS database we have also included estimates of heavy metals in the sludge coming from the municipal wastewater treatment plants. These are not emissions to water but rather the amount removed from the water. Some of these "removed" emissions will leach back into the waterways. These two numbers cannot be added together because one is *emissions to* waterways and/or to the municipal sewer system (INKOSYS) from enterprises that require discharge licences and the other is amounts *removed from* wastewater via sludge. There is no data available for the content of heavy metals in the effluent released into waterways after treatment in the treatment plants but there is not a 100 percent removal rate of these substances from the wastewater therefore there are some releases into recipient areas after passing through the treatment plants. Comparing the amounts removed from the water in the form of sludge to the amounts released by enterprises provides some insights into the need for further identification of sources of emissions. For some substances, for example copper, twice as much is removed in the sludge from the wastewater treatment plants than is released by the enterprises requiring a discharge licence. This would indicate that there are other major emissions sources of copper that are connected to the municipal wastewater system that need to be identified.

Some of the enterprises are connected to the municipal wastewater system so some of the amounts contained in the sludge originate from the enterprises. If the values for sludge content were added together to the emissions data from enterprises this would result in some double counting. The seriousness of this problem is difficult to estimate. Information is requested regarding whether the enterprise is connected to the municipal wastewater system or not, but unfortunately this information is not often provided. At this point we are simply providing both sets of values without trying to resolve the problems. This is work that needs to be done in the future. Including the amounts contained in the sludge from the municipal wastewater treatment plants provides some idea whether the major emissions are coming from enterprises that need to have a discharge licence or if they are also coming from other sources connected to the wastewater sewage treatment systems.

5.2.2 Evaluation of data from 1995, 1996 and 1997

For the 19 types of toxic substances being examined the emissions come primarily from the following NACE divisions:

NACE 13	Mining of metal ores
NACE 21	Manufacture of pulp, paper and paper products
NACE 24	Manufacture of chemicals and chemical products
NACE 27	Manufacture of basic metals

Emission types are heavily dependent on the types of processes and technology used by enterprises. Since the focus in this study is on emissions of heavy metals this means that these four divisions dominate as the primary emission sources.

1996 was the first year that NACE 90 (Sewage and refuse disposal, sanitation and similar activities) appears coded as such in the database. Comparing the values reported in 1996 with those reported in 1997 it would appear that the reporting for 1996 did not include the entire year. This would mean that the values for 1997 and later would have higher reporting values due to inclusion of this new NACE division.

Some data handling problems were encountered and a virus damaged the original data file for 1996. The replacement file included NACE 29 (Manufacture of machinery and equipment n.e.c.) which was not included in the other files received from SFT. This discrepancy also needs to be resolved in the future.

Another problem with the INKOSYS database information is related to the NACE code that is assigned to the enterprises by SFT. The NACE code is correct to 2 places (2-digit or division) but not

at more detailed level. When setting up the INKOSYS database the Norwegian Pollution Control Authority (SFT) has chosen to identify the major activity of the enterprise in slightly different ways than is found in the official business register and has assigned other NACE-codes to the enterprises than the one found in the business register. In this current pilot project we have used SFT's NACE classification and present categories at the 2-digit division level. If further work is going to be done, it will be necessary for us to compare the business register number for each company and identify the official NACE code for each enterprise.

Three data tables are presented at the end of this section on emissions of heavy metals showing the annual emissions in kilograms for each NACE division, a total for emissions from enterprises requiring a discharge licence and the content in the municipal sludge. This data is presented for three years, 1995, 1996 and 1997. The tables are shaded with grey where there are questions regarding the data. Consistency over the time period and consistency with SFTs reporting to the Euorstat/OECD joint questionnaire have been the focus of this comparison work.

The following is a list over the areas that need closer examination and revision. At this time these calculations must be considered very preliminary, since there has not been any formal agreement between Statistics Norway and the Norwegian Pollution Control Authority to contribute to the revision of the values in the INKOSYS database. Because of the legal responsibility of enterprises regarding their emissions and discharge licences, the data cannot be revised without necessary documentation and explanation. None the less, there are some major discrepancies over the 3-year period examined that need to be resolved before this data can be used to develop the NAMEA tables any further. See Tables 13 -15. NACE codes are described in more detail in Appendix Table A.1.

Ag - Silver
- Same amount reported in 1995 and 1996 for NACE 27 (9.055 kg) whereas in 1997 the amount reported was down to 3.512 kg.

Al - Aluminium
- NACE 27: 1997 figure is too low -- potential decimal error (100 tons not 8)

As - Arsenic
- NACE 27: 1996 possible keying error "103" whereas in 1995 and 1997 the value was closer to 130
- NACE 13: no reporting in 1997 from the NACE group with the highest emissions of this type

Au - Gold
- NACE 28: Large increase from 1995 to 1996 and back down to around 1995 level in 1997

Ba - Barium
- NACE 21: Low level reported in 1996
- NACE 90: Major new reporting of this type of emission. NACE 90 was not reporting before 1997.

Cd - Cadmium
- NACE 13: No reporting in 1995 but this is a minor source for this type of emissions
- Most emissions come from NACE 27.

Co - Cobalt
- NACE 27: Possible low reporting in 1996 (lowest value of the three years)

Cr - Chromium
- NACE 17: Large increase from 1995 to 1996
- NACE 18: Large increase from 1995 to 1996
- NACE 21: High value in 1996 compared to 1995 and 1997
- The trend over the three-year period is increasing, both from enterprises requiring a discharge licence and from the municipal wastewater treatment plants. This trend is the opposite of what the Ministry of the Environment has as a goal.

Cu - Copper
- NACE 13: Value for 1997 is too low. SFT's reporting to Eurostat/OECD shows a value of 62.00 tons vs. the 0.128 from the database. This may be due to the revision process currently underway at SFT.

- NACE 21: Appears to be a decimal error or lack of reporting in 1996
- NACE 90: substantial emissions reported in 1997. Much higher than in 1996.
- Unclear trend due to miss-reported value in 1997 for NACE 13. Unclear if goal set by the Ministry of the Environment is being reached.

Fe - Iron
- NACE 21: no reporting in 1996
- NACE 27: value in 1997 is too low as compared to 1995 and 1996 by several orders of magnitude
- NACE 29: only appears in 1996 but has significant emissions

Hg - Mercury
- NACE 24: emissions more than double from 1995 to 1997
- The trend is the opposite of the goal set by the Ministry of the Environment

Mn - Manganese
- NACE 21: no reporting in 1996
- NACE 24: no reporting in 1995. Industry is a major source of this type of emissions
- NACE 90: First year that this emission type is reported. NACE 90 accounts for a substantial portion of these emissions

Mo - Molybdenum
- NACE 21: reporting only in 1996
- NACE 27: potential decimal error in 1997

Ni - Nickel
- NACE 13: no value is reported to Eurostat/OECD even though there is a significant amount shown in 1997.
- NACE 21: Very high values reported in 1996
- NACE 24: increasing trend for all 3 years
- NACE 27: substantial reductions shown across all 3 years. Eurostat/OECD reporting in 1997 shows a value of 2.5 tons vs. the 1.5 from our calculations. This can be due to more recent data revisions at SFT.

Pb - Lead
- NACE 13: No reporting in 1997, no reporting to Eurostat/OECD, same value reported in 1995 and 1996.
- NACE 21: Appears to be a decimal error in 1996
- Unclear whether the goal set by the Ministry of the Environment is being reached.

Sn - Tin
- NACE 28: potential decimal error in 1996

Ti - Titanium
OK
V - Vanadium
OK

Zn - Zinc
- NACE 13: no reporting in 1997. This group has the highest level of this type of emissions
- NACE 15: no reporting in 1995
- NACE 21: no reporting in 1996

5.2.3 Emissions measured in the sludge removed from municipal wastewater

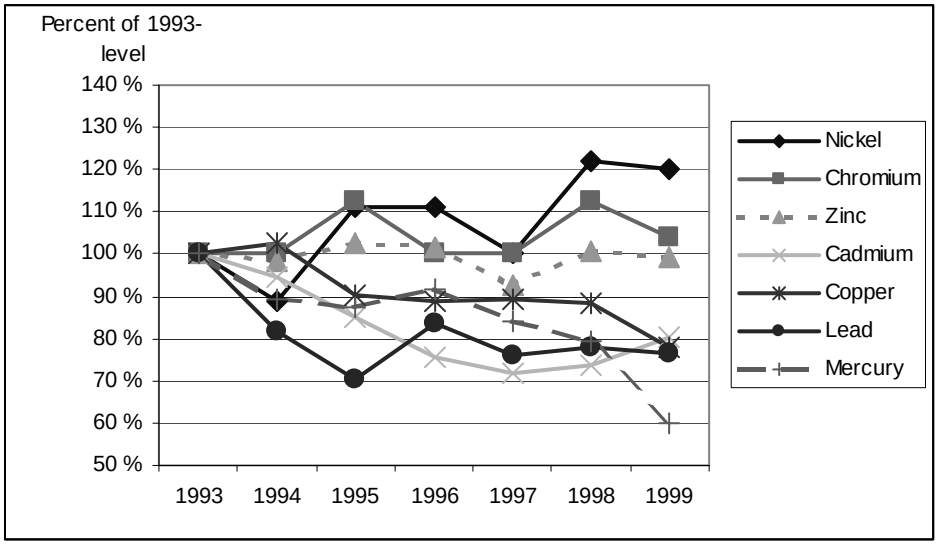
The content of heavy metals in the sludge removed from the wastewater systems is measured and reported annually for each wastewater treatment plant to another SFT administrative database (known as "SESAM"). Statistics Norway has been heavily involved with the development of this database and is responsible for the data revision and quality from the wastewater sector. This database is used by SFT for administrative purposes and by Statistics Norway for the production of statistics covering the wastewater sector. Data for seven heavy metals are available, cadmium, chromium, copper, mercury, nickel, lead and zinc from the SESAM database.

For chromium and mercury the amounts reported in the sludge are several times greater than the amounts reported as emissions from the enterprises that have discharge licences. This would imply that there are additional sources of these types of emissions that are connected to the municipal

wastewater systems. In addition, there appears to be important sources of copper, nickel, lead and zinc that are connected to the municipal wastewater system since there are substantial amounts of these metals in the sludge.

The following figure shows a time series of data for the seven types of toxic substances that are reported for municipal sludge using 1993 as the reference year. From this figure it appears that the amounts of mercury found in sludge are being drastically reduced but the emissions from industrial sources show a mixed picture for the time period 1995 to 1997. Drawing conclusions about trends is difficult from these two sets of data. Further work is needed before overall trends can be identified with confidence.

Figure 6. Heavy metals in sludge from municipal wastewater treatment plants. 1993 - 1999, reference year is 1993 (1993 level = 100%).



Statistics Norway, Wastewater statistics 1999. (http://www.ssb.no/emner/01/04/20/avlut/)

5.2.4 Next steps

The next steps for this part of the NAMEA would be to discuss data use and revision of the INKOSYS database with the Norwegian Pollution Control Authority (SFT). Since SFT is in the process of revising the data in this database before making it publicly available on the Internet some of the errors may be corrected. However, it is possible that additional data revision would be needed before this information can be used for producing reliable statistics.

Once the issue of data quality is resolved, then a more complete mapping of the flows needs to be undertaken to try to exclude double counting. This will require that better information regarding the enterprises' connection to the municipal wastewater system is obtained. Then there is the identification of the other major sources of heavy metal emissions that are indicated in the sludge content. These sources need to be classified as best as possible according to appropriate NACE divisions.

The timeframe for this work is uncertain. The Ministry of the Environment is very interested in having sector-based information. This may be a positive input to move the development of this part of the NAMEA along. On the other hand, the Norwegian Pollution Control Authority is focusing most of its efforts on improving the data quality for emissions to air and not on emissions to water.

5.2.5 References for NAMEA-Heavy metals

Ministry of the Environment 1996-97: White Paper No. 58. Miljøvernpolitikk for en bærekraftig utvikling: Dugnad for framtida.

Table 13. Emissions to water of heavy metals from enterprises having discharge licences, total emissions from enterprises with discharge licences, and heavy metal content in sludge from wastewater treatment plants. Kilograms. 1995.

1995 NACE	Ag Silver (kg)	Al Aluminium (kg)	As[1] Arsenic (kg)	Au Gold (kg)	Ba Barium (kg)	Cd[1, 2] Cadmium (kg)	Co Cobalt (kg)	Tot Cr[1] Total chromium (kg)	Cu[1, 2] Copper (kg)	Fe Iron (kg)	Hg[1, 2] Mercury (kg)	Mn Manganese (kg)	Mo Molyb-denum (kg)	Ni[1] Nickel (kg)	Pb[1, 2] Lead (kg)	Sn Tin (kg)	Ti Titanium (kg)	V Vanadium (kg)	Zn[1] Zinc (kg)
13			270						61 540					9 859	420				140 620
14																			
15									1 048					2 192					
17								14.3	107										
18								5.3											
19								129											
20																			
21		4.2			4.7	1.4	0.3	0.6	7 522	637	0.0	1 049		0.5	8				136
22								0.8	5					0.3					
23																			
24						27.6		13	566	283 555	5.1			1 627	495		319 000	441	2 400
25																			
26															1.5				
27		118 035	130			949	305	155	1 846	183 321	11.4	2 363	0.9	4 351	5 833		36	0.0	54 169
28	9.06	657		1.05		1.3		38	75	1 623		28		177	25	1 887			156
29																			
31									5	12			1.2	1.7	11	2			4.5
35																			
40						0.5					0.2				1.9				
60																			
74	0.16																		
75																			
90																			
INKOSYS Total	9.21	118 697	400	1.05	4.7	980	305	356	72 712	469 147	17	3 439	2.1	18 209	6 795	1 889	319 036	441	197 486
Content in sludge from municipal treatment plants						90		1 800	22 350		105			1 000	1 810				32 018

[1]Reporting of these heavy metals to the Eurostat/OECD joint questionnaire, Inland waters Table 7
[2]In the White Paper 58 (1996-1997) to the Parliament it is stated that these toxic substances are to be substantially reduced by the year 2010.
Values shaded in dark grey highlight data that need additional checking due to inconsistencies with other years.

Table 14. Emissions to water of heavy metals from enterprises having discharge licences, total emissions from enterprises with discharge licences, and heavy metal content in sludge from wastewater treatment plants. Kilograms. 19956.

1996 NACE	Ag Silver (kg)	Al Aluminium (kg)	As[1] Arsenic (kg)	Au Gold (kg)	Ba Barium (kg)	Cd[1, 2] Cadmium (kg)	Co Cobalt (kg)	Tot Cr[1] Total chromium (kg)	Cu[1, 2] Copper (kg)	Fe Iron (kg)	Hg[1, 2] Mercury (kg)	Mn Manganese (kg)	Mo Molyb-denum (kg)	Ni[1] Nickel (kg)	Pb[1, 2] Lead (kg)	Sn Tin (kg)	Ti Titanium (kg)	V Vanadium (kg)	Zn[1] Zinc (kg)
13			552			9			40 740					8 587	420				122 950
14																			
15									786					418					
17			0.3			1.3	0.5	75	140		0.1			0.8	13	0.4			103
18								39											
19								73											
20																			
21		2	0.0		3.7	0.5	1.8	9	0.2				3.7	589	791	2.5			
22								0.7	4					0.3					
23																			
24						14		10	377	294 883	8.1	2 422		2 270	117		260 200	284	1 696
25																			
26															5				
27	0.020	128 205	103			956	154	159	1 562	197 890	6.6	1 339	6.1	2 193	3 102				43 701
28	4.268	1 803		2.67		0.8		55	52	986		8		159	0.8	215			299
29								29		191				4.1					
31									1.7	18			1.1	3.4	10	1.5			5
35																			
40						0.4					0.5				2.8				
60																			
74	0.124																		
75																			
90									0.1	17				0.1	0.2				1
INKOSYS Total	4.412	130 010	655	2.67	3.73	981	156	450	43 663	493 985	15	3 769	11	14 225	4 462	220	260 200	284	168 755
Content in sludge from municipal treatment plants						80		1 600	22 034		110			1 000	2 150				31 775

[1]Reporting of these heavy metals to the Eurostat/OECD joint questionnaire, Inland waters Table 7
[2]In the White Paper 58 (1996-1997) to the Parliament it is stated that these toxic substances are to be substantially reduced by the year 2010.
Values shaded in dark grey highlight data that need additional checking due to inconsistencies with other years.

Table 15. Emissions to water of heavy metals from enterprises having discharge licences, total emissions from enterprises with discharge licences, and heavy metal content in sludge from wastewater treatment plants. Kilograms. 1997.

1997 NACE	Ag Silver (kg)	Al Aluminium (kg)	As[1] Arsenic (kg)	Au Gold (kg)	Ba Barium (kg)	Cd[1, 2] Cadmium (kg)	Co Cobalt (kg)	Tot Cr[1] Total chromium (kg)	Cu[1, 2] Copper (kg)	Fe Iron (kg)	Hg[1, 2] Mercury (kg)	Mn Manganese (kg)	Mo Molyb-denum (kg)	Ni[1] Nickel (kg)	Pb[1, 2] Lead (kg)	Sn Tin (kg)	Ti Titanium (kg)	V Vanadium (kg)	Zn[1] Zinc (kg)
13						2.4			128					5 294					
14																			
15									613					198					
17			17			1.9	7.3	65	201		0.3			11	23	15			494
18								42											
19								82											
20																			
21		0.9			4.6	1.9		0.4	5 852	433	0.0	772		8	8				76
22									4					0.0					
23										39				11	0.0		44	39	0.0
24						23		11	560	329 111	12	2 520		4 244	230		280 300	594	3 272
25																			
26					0.01	0.00					0.0				0.0				
27		8 891	130			938	200	232	2 018	824	7	989	120	1 496	3 917		24	6.0	43 176
28	3.512	3 750		1.122		0.2	2.8	60	51	1 165		17		169	19	206			150
29																			
31									2	9			1.0	1.1	4.4	0.9			3.6
35																			
40						0.02					0.1				0.3				
60																			
74																			
75																			
90			0.2		32	0.7			1 505	251	0.3	2 541	0.6	176		0.3		4.6	2 983
INKOSYS total	3.512	12 642	147	1.122	36	968	210	492	10 934	331 832	19	6 838	122	11 608	4 201	222	280 368	644	50 155
Content in sludge from municipal treatment plants						76		1 600	22 100		101			900	1 960				28 900

[1]Reporting of these heavy metals to the Eurostat/OECD joint questionnaire, Inland waters Table 7
[2]In the White Paper 58 (1996-1997) to the Parliament it is stated that these toxic substances are to be substantially reduced by the year 2010.
Light grey shading are values that are substantially different from the values reported in Table 7 of the Eurostat/OECS joint questionnaire on Inland waters
Values shaded in dark grey highlight data that need additional checking due to inconsistencies with other years.

5.3 Emissions of phosphorus and nitrogen

5.3.1 Introduction

For substances that readily dissolve in water, are retained in the local environment or can be retained further downstream it becomes difficult to identify the flows and to determine the actual source of the emissions that are being observed downstream. In some cases emissions of nitrogen can be positive for the recipient area whereas in other cases the recipient area cannot tolerate additional emission loads. In addition to the problem of retention there is a problem of double counting. Modelling the flows and retention is necessary to avoid double counting as the dissolved components flow down the water sheds.

The NAMEA framework uses the national accounts as the basis for defining what should be included and excluded. Roughly speaking this means that only emissions connected to the economic definition of the country should be included in the NAMEA. For nitrogen and phosphorus this will only include about half of the total amount that is emitted to the coastal waters. This is due to the large amounts that come from the runoff from pristine nature areas. To focus only on the contributions from industry and the municipal wastewater systems is to exclude a large amount of emissions for these two substances.

If emissions from enterprises and emissions from wastewater treatment plants are used this can lead to substantial double counting. There is a complex model that has been developed to calculate the emissions of nitrogen and phosphorus to the North Sea area taking into account retention rates along the different watersheds and the location of the major emissions sources from enterprises, treatment plants, agricultural areas and natural areas. This model, known as TEOTIL, provides information concerning the emissions to the geographic boundary of the country. It does not include the emissions from NACE 05.02 (Operation of fish hatcheries and fish farms) if these activities are located in salt-water areas. In Norway most of the major fish farming occurs on the fjords along the west coast and in the northern parts of the country. The TEOTIL model is used for reporting to the Paris convention regarding emissions to the North Sea (Holtan et al. annually from 1991).

Determining exactly which emissions to include in the NAMEA in this case becomes a question of providing information about the "pressure" that is contributed by various parts of the economic activity in the country or providing information about the "state" of the watersheds. If the emissions are measured from the point of origin there will be some double counting from the wastewater treatment plants. This approach provides information about the "pressure" that is being put on the watershed from the emission source. This data is basically the input data into the TEOTIL model.

If a "state" approach is desired then the output of the model would need to be presented. The problem with the information after the TEOTIL model is run is that it is not possible to reassign the amounts to detailed NACE divisions since the model only has four major categories (agriculture and forestry, municipal wastewater, "industry" and natural runoff from pristine areas). The calculations from the model are concentrations of nitrogen and phosphorus to the various recipient bodies of water and in particular to the North Sea. The model predictions and the measured values for phosphorus are relatively close whereas there is not as good agreement for the nitrogen values.

5.3.2 Evaluation of data from 1995, 1996 and 1997

The "state" view is a more conceptually appealing way of viewing the environment and the values for 1996 are provided in Table 17 however only with four groups that do not correspond with NACE categories. Due to the difficulties of re-assigning the values back to the NACE divisions we can only present the "pressure" (or input data to the TEOTIL model) approach according to detailed NACE groups (Table 16).

Table 16. Emissions of phosphorus and nitrogen from enterprises reporting to the INKOSYS administrative register. 1995- 1997. Tonnes

NACE	Phosphorus (tonnes)			Nitrogen (tonnes)		
	1995	1996	1997	1995	1996	1997
13	0.8	0.0		2.2	1.2	1.2
14						
15	50.1	128.8	54.0	403.4	432.3	432.5
17	6.8	8.3	9.1	0.4	1.1	
18		0.0				
19	0.1	0.1	0.1	91.8	26.0	20.0
20	1.6	1.4	1.8	9.2	5.5	11.1
21	94.1	95.1	83.0	888.9	820.6	628.9
22		0.0				
23	2.2	2.1	3.6	2.2	0.5	0.4
24	27.7	35.7	52.7	1 690.4	2 329.8	2 496.2
25	8.5	7.1	10.0			
26		0.3	0.1	0.3	0.3	0.1
27	1.7	1.2	1.3	43.0		710.4
28	0.9	1.7	374.0	4.4	4.2	2.5
29	..	0.2	..	..	1.5	..
31						
35	0.2	0.2	0.0	0.0	0.0	0.0
40						
60						
74						
75						
90						3.6
Total	**194.8**	**282.7**	**589.8**	**3 136.2**	**3 623.1**	**4 307.0**

Table 17. Emissions of phosphorus and nitrogen to the Norwegian coastal areas calculated using the TEOTIL model. 1996. Tonnes.

1996	Phosphorus	Nitrogen	Comments
Agriculture, hunting and forestry	663	21 988	NACE 01-02
Municipal wastewater	1 479	19 370	Includes households and all other institutions and enterprises connected to the wastewater systems
Industry	241	3 908	Data source: INKOSYS; NACE 13, 15-37, 90 excludes those connected to sewage systems so takes into account some of the potential double counting
Natural runoff from pristine areas	1 246	55 016	Outside NACE definision
Total	3 629	100 282	

Source: Bratli 1998.

Again the data from the INKOSYS database will need to be revised. In addition the information regarding the connection to the municipal waste water system needs to be more complete. The categories that the TEOTIL model uses are too different from NACE to be very useful. The category "industry" does not correspond to the manufacturing industry but instead refers to the data obtained from the Norwegian Pollution Control Authority's INKOSYS database approximately NACE 13, 15-37 and 90 for these types of emissions. There is no attempt to allocate emissions from the municipal wastewater systems to households or enterprises or institutions. More detailed information is needed before allocations could be made. In a few years there may be new information that can be helpful in this process.

5.3.3 Conclusions and further work

A building register is being established as part of the population and housing census for 2001. Part of this register includes geographic information and information related to a building's connection to the sewer system. Once this register is established and connected to the population information it will be possible to establish which buildings are connected to the sewer system and how many people are living in each building In addition, there is another project to establish the geographic location of each

enterprise. This project will also hopefully provide information that can be used to help identify the likelihood that the enterprise is connected to the sewer systems. It is expected that these two projects will produce better estimates regarding which buildings and users are connected to the municipal wastewater treatment systems. Based on this new information it is expected that more precise estimates could be made regarding the allocation to different NACE groups. Until these registers are more fully established and operational it is not expected that more work can be done in this area.

It is felt that some additional conceptual work needs to be done for the wastewater NAMEA, especially for nitrogen and phosphorus. It can be argued that wastewater is produced by individuals and is not necessarily a function of production and therefore all wastewater connected to individuals should be classified as coming from "households". Individuals produce wastewater no matter whether they are at work or at home so wastewater from individuals is not really a function of which NACE category they work in but is a function of being alive. That an individual produces a certain amount of wastewater during working hours is not a function of that industry. Exactly what is to be included in the wastewater NAMEA needs to be clarified before allocations can be made.

5.3.4 References for phosphorus and nitrogen NAMEA

Bratli, J.L. (1998): *Resultatkontroll jordbruk - Effekt av tiltak mot forurensninger. Målte og modellerte tilførsler av næringssalter. Vannkvalitet i hovedvassdrag.* NIVA Report 3799-98.

Holtan, G., D. Berge, H. Holtan, T. Hopen, (1991): *Paris convention. Annual report on direct and riverine inputs to Norwegian coastal waters during the year 199x. A: Principles, results and discussions. B. Data report.* NIVA-report and SFT-report.

6. NAMEA: Air emissions - revised data tables

The air emissions model for Norway is continually updated. New emissions factors, revised emissions data and other types of revisions are changed when necessary (Flugsrud et al. 2000). This means that the emissions tables produced for the NAMEA matrices need to be updated at least annually. The national accounts data are only revised periodically when there is a major revision. New data tables have been generated based on the latest version of the air emissions model and data set. These updated tables are included in the appendix to this report. The NACE classification in these revised tables is according to the NAMEA-2000 categories as requested from Eurostat. Therefor these tables are slightly different from the previously published tables.

These data are also being reported to Eurostat as part of the NAMEA-2000 reporting. The NAMEA-2000 economic tables can be provided as requested as well as the emissions tables. The table that requires additional work is the information requested in Table 3 which is the "link" table between NAMEA-based data and other air emissions reporting. Since the Norwegian air emissions model is run specially with NAMEA-variable definitions it has not been necessary to add or subtract amounts from the other air emissions reporting (for example, CORINAIR). The differences between the NAMEA and EEA/Eurostat/IPCC reporting will need to be investigated in more detail. This work is included as part of the work planned for next year.

6.1 NAMEA Air emissions references

Flugsrud, K., E. Gjerald, G. Haakonsen, S. Holtskog, H. Høie, K. Rypdal, B. Tornsjø and F. Weidemann (2000): *The Norwegian Emissions Inventory: Documentation of methodology and data for estimating emissions of greenhouse gases and long-range transboundary air pollutants.* Statistics Norway and Norwegian Pollution Control Authority. Report 2000/1.

7. SERIEE for the public wastewater sector

The public wastewater sector in Norway accounts for the majority of the wastewater treatment in the country. There are treatment plants of various types and sizes owned by private enterprises that treat industrial wastes and there are some private treatment plants that service smaller numbers of households. Economic information from these types of installations is not reported in a way that is easily separated from other types of investments and expenses. For this reason we are focusing on the public sector wastewater sector as the first attempt at a SERIEE-type of analysis for the wastewater sector.

7.1 Data sources

There are two major sources of economic data for the municipal wastewater sector. One source is from the annual municipal wastewater survey conducted by Statistics Norway (SSB) in co-operation with the Norwegian Pollution Control Authority (SFT). The other data source is the economic accounts reported from each of the 435 municipalities to Statistics Norway.

The annual SSB/SFT survey has included questions regarding investment and running costs since 1993. The municipality's capital costs are calculated using an annuity method. This method uses a specified interest rate (with a one percent risk premium added) and the investments over a 20 year period (excluding subsidies). Each municipality reports annually to this survey. The results are published usually in early October (see Statistics Norway's Internet web pages for latest article: http://www.ssb.no/english/subjects/01/04/20/avlok_en/).

The second source of data regarding the municipal wastewater system is obtained from the economic accounts that each municipality reports to Statistics Norway. This information is transformed and used in generating parts of the national accounts. There is a major revision of the municipal accounts occurring. At the moment approximately half of the 435 municipalities are using the old system and half have converted to the new system. There are a number of major changes regarding the accounting rules and methods between these two systems. In the year 2002 all of the municipalities will be using and reporting to the new system. When this happens it should be possible to obtain reasonably good, detailed economic information regarding the wastewater sector. This will also mean that the definitions used in the accounting systems will be the same. For example, all municipalities will be required to use linear depreciation and to show the depreciation broken down according to all of the various activities and not only as one lump sum as is often the current practice under the "old" system.

7.2 Evaluation of data sources with respect to the SERIEE tables

A general comparison has been made between the SSB/SFT survey information and the "old" municipal accounts data to try to determine where to start for a SERIEE analysis. The analysis also provided insights into areas that need changes in the new accounting system. For some municipalities there is reasonably good agreement between these two sets of data but not for others. There are a number of reasons that we have found for these discrepancies. A major difference relates to how the financing of investments is being reported. In the "old" municipal accounts there were several choices for how the municipality dealt with this. It was very common that all financing expenses for the municipality were lumped together as one sum and not allocated to each activity area (for example, solid waste or wastewater). In the annual wastewater survey these amounts are spit out and reported. Overhead expenses were also included in the annual survey but are not able to be separated out in the municipal accounts. In the new municipal accounts (known as KOSTRA) these problems will be resolved by a combination of changes in the municipal accounts, accounting rules and separate reporting. One of the goals of the KOSTRA-reporting system is to avoid double reporting, as is the practice today with the annual survey and the annual financial accounts. But this means that enough detail is needed from the KOSTRA system to cover the information needs for everyone that uses this type of data. From 2002 it is planned that the economic reporting to KOSTRA will replace the reporting to the annual SSB/SFT survey for the wastewater sector.

In many ways the data obtained from the present annual survey is more complete than the "old" municipal accounting since it is at a better level of detail for certain things than the current municipal accounts (specifically income from fees, overhead costs, capital costs). But we have also found that some municipalities report budgeted amounts and not actual amounts. The other problem with the survey data is that we do not have the detailed information regarding the transfer of funds from one level of government to another. Another problem of the survey data is that the current transactions are only given as one figure and not in the detail needed in SERIEE Table B. However, this information is available in the municipal accounts.

Due to the major changes in the municipal accounts (KOSTRA) it makes more sense to wait to do these calculations until 2002. On the other hand we still have a chance to make small adjustments to the system this year. Once all of the municipalities start to use the system it will be much harder to implement changes. We have been very active in trying to be certain that the information and the detail that we need will be available from the KOSTRA system. For these reasons we want to review the data needs in the SERIEE tables, review our current data and determine if we will be able to obtain the necessary information from KOSTRA once KOSTRA-data becomes available.

The following table presents the major results from the annual survey.

Table 18. Annual costs and income from user fees in the municipal wastewater sector. Billion NOK. 1993-1999.

Year	Overhead, running and maintenance costs	Capital costs	Total Costs	Income from user fees
1999	2.08	1.96	4.04	3.66
1998	1.93	1.60	3.53	3.46
1997	1.85	1.41	3.26	3.28
1996	1.78	1.47	3.25	3.09
1995	1.71	1.50	3.21	2.96
1994	1.60	1.43	3.03	2.75
1993	1.44	1.60	3.04	2.36

Source: Wastewater statistics, Statistics Norway

The results from the current annual survey do not provide enough detail to be able to fill in the SERIEE tables. From the survey data it is not possible to identify, for example, intermediate consumption, compensation of employees, subsidies, or taxes on production (needed in Table B). But this data will be available from the new KOSTRA-accounts.

For the wastewater sector we will be able to identify separate amounts for income from fees paid by users for sewage systems and for septic tanks (defined as a "1.3 Final consumption of connected products" in Table A). One problem that has not been resolved is how to split up the income from fees paid by households and the income amount paid by others (schools, hospitals, enterprises, etc.) that are also connected to the municipal wastewater system. In the municipal accounts there will be only one figure reported as "income from fees." It will be necessary to allocate this fee income between "households" and "other producers" for filling in Table A. The household amount will be entered in column "Households as actual consumers" and row "1.1 Final consumption of characteristic services, market." The income from non-households would be entered in rows "1.2 Intermediate consumption of characteristic services, market or ancillary" and in columns for "other producers." Some of the same allocation principals developed for the physical data for the NAMEA for water emissions could be used here. It is expected that better information regarding the connection to the waste water system will be obtained in connection with the establishment of the new dwelling register that is part of the 2001 population census. Other possible allocation information could be obtained from household budget analyses or by using physical data obtained from the treatment plants.

The problem of allocation of the wastewater fees between "households" and "others" is a problem also shared with the regular National Accounts. In the former main revision of the national accounts, the allocation to households was based on expert judgements of a working group with members from the

National Accounts and the division for Public Finance and Credit Market Statistics. To decide on the fees paid by the households, they had data for this fee from the Household Budget survey, as well as the survey of Housing conditions, which asked for a sum of several fees related to housing and could be linked to the Census information on dwellings. According to the national accounts, households paid 51,4% of the product 'municipal sewage fees' in 1997. The rest of this fee is lumped together with other fees and various business services etc. before being distributed by industry for intermediate consumption. The specific allocation by industry of the wastewater fees is not possible to identify.

Transfers from one level of government to another will be possible to identify from the KOSTRA accounts. Determining whether these are "subsidies and other specific transfers" that are part of Table A or whether they are "Investment grants and other transfers" that are part of Table C will be difficult to determine from the municipal accounts. Information regarding grants (for Table C) will need to be checked using the national budget from the government or by obtaining data directly from the counties if there are grants from the county level. The county accounts do not have detail for the wastewater sector since it is a function of the local government and not the county government. The county provides some grants so this will need to be investigated if the municipality shows a transfer from the county. In the wastewater sector, it is more common that the grants are provided from the state and not the county level.

The information available for general government activities for environmental related activities shall be much better when the new COFOG classification of government consumption expenditures by purpose is implemented. In the present statistics for general government, some information can be found under the heading 'dwellings and the local environment', deep down in the classification structure. A discussion of this data is given in the report from phase 1of the NOREEA project (Hass and Sorensen, 1999). This data should in principle correspond to the data to be reported at the first level of the new COFOG. The present plans for implementation of the new COFOG says that the data shall be available by the end of 2001. The reclassification according to the new COFOG will be given back to 1990, and will also be used for the present 'small' revision of the National Accounts.

Our conclusion is, that it is still too early to try to fill out the SERIEE tables since the KOSTRA accounting system and the number of municipalities reporting to this system are still in the development stage. It is still valuable to evaluate the progress being made towards the desired end result of reporting to the SERIEE method.

So far, we have focussed on the local government sector wastewater activities. There is some statistics for private establishments, but so far not sufficiently detailed to identify wastewater activities. This is generally also the case for central government. However, we have some data for the activities of the Ministry of Environment. For Central Government, data will be generally available as a result of the implementation of the new COFOG classification.

For comparison with the data presented above, we include a table for expenditures of the Ministry of Environment according to the classification by purpose presented by the Ministry in its budget report for 1998-1999. The figures are from the central government accounts for 1997.

Table 19. Expenditures of the Ministry of Environment 1997 by purpose categories. Million NOK.

	Total	**2 827**
	Purpose category:	
1	Conservation and sustainable use of biological diversity	472
2	Outdoor recreation	66
3	The cultural heritage	210
4	Pollution abatement for oceans and water	332
5	Chemicals dangerous to health and the environment	109
6	Solid waste and recycling	488
7	Climate change, air pollution and noise abatement	97
8	International co-operation and aid for environment protection, work in northern and polar regions	223
9	Regional planning	116
10	Maps and Geographical Information Systems	294
11	Organisation and budgets	418

We see that expenditures for the purpose category 'Pollution abatement for oceans and water' amounts to ca. 10% of the expenditures found in the survey of the municipal wastewater sector given above. The largest contribution to this category was expenses for the Norwegian Pollution Control Authority. Their expenditures for this purpose category amounted to 78% of the total for the Ministry. In order to use the data reported here, we should like to be able to break down the figures by kind of expenditures. The table above includes all expenditures such as transfers to local governments, subsidies to non-government institutions etc. The required detail can probably be found by inquiring further into the details of the government accounts. This is, however, exactly what the division for Public Finance and Credit Market Statistics is doing in order to implement the new COICOP classification. So, we shall wait for their results to include Central government in the analyses.

7.3 Next steps

There are several different directions that can be pursued. One direction is to make some trial calculations based on the new KOSTRA accounting system. The new KOSTRA accounting system has been established (with only minor revisions expected) and used by approximately 100 municipalities for at least one year now. Data is now available from these municipalities for fiscal year 1999. The change to the new KOSTRA accounting system requires some major revisions for the municipalities so the first year's economic data is not always that good. It would be possible to make some trial calculations based on these data from 1999 and to attempt to fill out the SERIEE tables using this data. One drawback is that the detail for the septic tanks will not be available until 2002 for the fiscal year 2001.

A second direction that needs to be investigated is regarding information about the private sector. Although most wastewater treatment plants are operated by the municipal government, there are privately owned and operated plants. The municipal accounts will only provide detailed data from the local government. The private sector also needs to be investigated. As a part of the annual SSB/SFT survey, information from each wastewater treatment plant (over a certain size) is also obtained. The ownership of these treatment plants is part of the information contained in the database. The privately owned treatment plants can be fairly easily identified. There is no economic information obtained in the annual survey for these privately owned treatment plants but it may be possible to identify some of them in the business register.

8. Appendices

Norwegian Air Emissions, Value Added, Energy use and Employment Tables for 1991 - 1997

The following tables provide air emissions data for 1991 to 1997 for detailed industries. The twenty-three types of air emissions are: NO_x, N_2O, SO_2, NMVOC, CH_4, CO, CO_2, NH_3, Particulates, and Lead (Pb), Cadimium (Cd), SF_6, HFC-23, HFC-32, HFC-125, HFC-134, HFC-143a, HFC-152, HFC-227ea, PFC-14, PFC-116, PFC-218. The set of tables also includes energy consumption, value added and employed full-time equivalent man-years for Norwegian industries for 1991 to 1997.

Please note:
The industry Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods (code 50) is an aggregation for the NACE groups 50, 51 and 52.
The industry Financial intermediation (code 65) is an aggregation of the NACE groups 65, 66 and 67.
The industry Real estate, renting and business activities (code 70) is an aggregation of the NACE groups 70, 71, 72, 73 and 74.

Table A.1 Industry codes

Industry code	Industry
01	Agriculture, hunting and related service activities
02	Forestry, logging and related service activities
05	Fishing, operation of fish hatcheries and fish farms
10	Mining of coal and lignite; extraction of peat
11	Extraction of crude petroleum and natural gas; service activities
13	Mining of metal ores
14	Other mining and quarrying
15	Manufacture of food products and beverages
16	Manufacture of tobacco products
17	Manufacture of textiles
18	Manufacture of wearing apparel; dressing and dyeing of fur
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture af articles of straw and plaiting materials
21	Manufacture of pulp, paper and paper products
22	Publishing, printing and reproduction of recorded media
23	Manufacture of coke, refined petroleum products and nuclear fuel
24	Manufacture of chemicals and chemical products
25	Manufacture of rubber and plastic products
261	Manufacture of glass and glass products
269	Manufacture of non-metallic mineral products n.e.c.
271	Manufacture of basic iron and steel
279	Other manufacture of basic metals
28	Manufacture of fabricated metal products, except machinery and equipment
29	Manufacture of machinery and equipment n.e.c.
30	Manufacture of office machinery and computers
31	Manufacture of electrical machinery and apparatus n.e.c.
32	Manufacture of radio, television and communication equipment and apparatus
33	Manufacture of medical, precision and optical instruments, watches and clocks
34	Manufacture of motor vehicles, trailers and semi-trailers

Table A.1 Industry codes

Industry code	Industry
35	Manufacture of other transport equipment
36	Manufacture of furniture; manufacturing n.e.c.
37	Recycling
401	Production, collection and distribution of electricity
403	Steam and hot water supply
41	Collection, purification and distribution of water
45	Construction
50	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
55	Hotels and restaurants
601	Transport via railways
602	Other land transport
603	Transport via pipelines
611	Ocean transport and coastal water transport abroad
619	Inland water transport including coastal transport between national harbours
62	Air transport
63	Supporting and auxiliary transport activities; activities of travel agencies
64	Post and telecommunication
65	Financial intermediation
70	Real estate, renting and business activities.
75	Public administration and defence; compulsory social security
80	Education
85	Health and social work
90	Sewage and refuse disposal, sanitation and similar activities
91	Activities of membership organisation n.e.c.
92	Recreational, cultural and sporting activities
93	Other service activities
95	Private households with employed persons
	Codes for private household consumption
990	Private household consumption, total
991	Household's own account transportation
992	Household's consumption of light and heating for dwellings
993	Other private household consumption

Table A.2 Emissions to air of NOx for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	466 501	438 602	415 169	416 875	439 073	478 907	467 023
Sum emissions from industries	427 710	402 684	380 652	384 171	408 913	450 707	442 174
01	7 362	7 325	6 540	6 629	5 561	5 571	5 434
02	854	817	831	746	819	720	749
05	30 161	28 202	27 766	29 159	29 564	33 051	34 694
10	27	12	33	60	49	33	31
11	37 390	39 451	45 226	44 091	44 943	48 562	53 020
13	459	398	413	409	322	293	198
14	1 130	973	1 081	1 464	1 435	1 190	1 090
15	1 849	1 616	1 678	1 951	1 746	1 731	1 564
16	18	22	21	23	22	18	13
17	68	55	64	104	77	125	111
18	9	5	6	15	10	15	14
19	8	7	8	18	16	17	14
20	478	516	592	512	521	546	548
21	1 218	1 061	1 109	1 841	1 746	2 051	1 771
22	102	63	72	67	65	74	66
23	2 076	3 424	3 351	2 989	2 703	2 748	2 670
24	2 958	2 300	4 388	5 032	4 539	4 494	5 097
25	73	49	63	85	74	91	91
261	105	125	105	110	98	128	240
269	4 362	2 950	4 103	4 613	4 860	4 645	4 573
271	6 062	5 497	4 228	4 860	4 791	4 998	5 083
279	1 743	1 179	1 176	1 335	1 359	1 393	1 409
28	170	135	200	188	175	204	208
29	222	114	164	213	173	218	227
30	3	3	3	1	1	0	0
31	58	39	95	163	128	127	118
32	14	8	6	9	4	4	4
33	1	0	3	2	2	3	4
34	21	30	35	54	51	61	89
35	301	274	237	262	178	179	169
36	83	71	73	91	88	121	109
37	0	0	0	28	10	21	47
401	278	321	352	370	274	229	227
403	1 115	1 238	962	1 021	1 055	1 123	1 143
41	0	251	245	216	123	121	114
45	5 495	5 526	5 085	5 794	6 538	6 017	6 289
50	9 410	9 016	9 152	8 553	8 560	8 319	8 032
55	90	89	106	76	84	108	99
601	1 373	1 456	1 524	1 567	1 537	1 048	1 106
602	20 206	22 428	26 991	22 276	24 303	26 366	24 221
603	34	35	36	42	37	46	44
611	255 622	229 112	197 626	201 822	223 643	255 687	241 411
619	22 919	24 140	23 708	24 126	25 903	27 600	29 619
62	2 875	2 980	3 163	3 245	3 819	3 773	3 799
63	1 872	1 481	1 500	1 344	1 100	1 135	1 166
64	1 036	977	1 008	904	828	746	739
65	368	335	349	301	271	254	238
70	1 221	1 177	456	472	570	580	562
75	3 089	4 156	3 493	3 517	2 986	3 028	2 929
80	256	222	192	194	172	214	166
85	480	460	505	627	461	473	428
90	112	118	121	79	77	42	39
91	15	16	30	28	27	23	19
92	48	43	28	43	53	56	57
93	411	386	350	430	362	287	272
Sum emissions from households	38 791	35 918	34 517	32 704	30 160	28 200	24 849
991	35 890	33 182	31 676	29 823	27 299	25 094	21 783
992	1 673	1 508	1 615	1 655	1 638	1 881	1 836
993	1 228	1 228	1 226	1 226	1 222	1 226	1 230

Table A.3 Emissions to air of N_2O for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	17 283	15 069	16 168	16 504	16 770	16 811	15 810
Sum emissions from industries	17 010	14 766	15 790	16 040	16 217	16 127	15 007
01	9 681	9 392	9 550	9 374	9 537	9 399	8 543
02	21	20	21	19	20	18	19
05	34	32	32	33	34	38	40
10	0	0	0	0	0	0	0
11	66	71	80	81	83	88	92
13	5	3	7	5	5	3	4
14	20	13	15	27	31	24	20
15	6	6	6	8	8	8	8
17	0	0	0	0	0	1	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	19	18	21	21	22	22	26
21	56	53	54	63	65	60	64
22	0	0	1	1	1	1	1
23	12	15	15	15	13	14	15
24	6 104	4 168	5 037	5 369	5 289	5 229	4 785
261	1	1	1	1	1	1	1
269	9	4	4	14	16	29	27
271	0	1	1	0	0	1	0
279	3	3	2	3	3	3	3
28	1	1	1	1	1	1	1
29	1	0	1	1	1	1	1
31	0	0	0	1	1	1	1
34	0	0	0	0	0	1	1
35	1	1	1	1	1	1	1
36	1	0	0	0	1	2	1
401	2	3	3	4	3	3	3
403	2	2	3	2	2	3	3
41	0	1	1	1	0	0	0
45	90	93	84	101	113	117	130
50	35	41	54	66	86	110	145
55	1	1	1	1	1	2	2
601	35	37	39	40	39	27	28
602	33	39	50	50	60	73	90
603	0	0	0	0	0	0	0
611	314	281	242	248	274	314	296
619	28	30	29	30	32	34	36
62	31	33	35	35	42	42	42
63	3	3	3	3	3	4	5
64	5	6	8	10	12	15	20
65	2	2	3	4	4	6	7
70	6	7	2	3	5	8	10
75	12	14	11	15	14	12	13
80	2	2	2	2	3	4	4
85	3	4	5	7	7	9	129
90	362	362	362	375	378	392	383
92	1	1	1	1	1	1	1
93	2	2	2	4	5	5	6
Sum household emission	273	303	378	464	553	684	803
991	183	218	279	360	452	576	685
992	87	83	97	101	98	105	115
993	3	3	3	3	3	3	3

Table A.4 Emissions to air of SO_2 for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	143 497	126 489	114 790	110 863	101 418	112 118	107 667
Sum emissions from industries	141 289	124 525	112 885	109 094	100 121	110 788	106 430
01	617	508	395	293	246	252	218
02	47	41	36	21	22	17	17
05	1 661	1 150	935	659	686	664	659
10	10	9	5	4	4	2	4
11	1 244	837	911	536	540	438	507
13	881	615	482	440	276	235	47
14	98	80	90	82	73	53	61
15	1 044	1 092	929	969	641	729	719
16	12	3	3	2	2	1	1
17	64	47	47	52	40	72	41
18	2	1	1	1	1	1	1
19	2	2	2	2	2	2	1
20	279	190	174	177	200	265	220
21	2 923	2 077	1 293	2 490	2 456	3 335	2 435
22	10	6	5	4	4	5	4
23	3 546	3 081	2 314	1 900	1 936	1 699	2 017
24	6 116	5 664	7 806	8 622	9 298	8 748	6 831
25	48	22	34	37	32	38	26
261	242	262	172	175	140	215	133
269	1 269	761	1 349	1 524	1 930	1 765	1 923
271	9 969	7 543	7 526	7 568	7 524	6 777	6 568
279	4 852	3 980	2 836	2 499	2 117	2 243	2 355
28	38	35	34	21	21	19	16
29	63	23	30	22	22	27	32
31	14	9	72	69	53	73	68
32	1	1	1	1	0	0	0
33	2232	2003	1927	1812	1336	1373	1 237
34	15	12	9	7	8	8	10
35	110	81	71	50	40	40	35
36	18	16	14	10	10	17	12
37	0	0	0	2	4	4	7
401	23	25	25	20	14	12	12
403	744	765	689	890	726	797	664
41	0	29	25	14	12	10	10
45	412	392	295	225	240	196	212
50	578	525	498	380	341	325	281
55	29	30	37	14	21	34	26
601	88	86	74	51	48	30	31
602	1 577	1 679	1 770	978	1 092	1 051	1 045
611	96 995	88 001	77 815	74 782	66 185	77 543	76 111
619	2 408	1 983	1 407	1 043	1 169	988	1 251
62	120	104	145	128	195	211	196
63	94	72	69	42	36	36	34
64	42	31	31	28	16	15	13
65	29	25	26	18	9	17	12
70	49	48	25	21	22	23	21
75	207	236	161	117	116	121	118
80	64	46	41	47	44	73	49
85	220	170	157	138	86	112	78
90	22	30	33	6	3	2	2
91	17	17	27	18	18	14	11
92	11	10	6	5	6	12	10
93	133	70	26	78	58	49	38
Sum household emissions	2 208	1 964	1 905	1 769	1 297	1 330	1 237
991	911	878	857	829	371	357	284
992	1 223	1 015	983	886	892	942	926
993	74	71	66	54	34	30	27

Table A.5 Emission to air of NMVOC for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	319 130	340 115	354 428	365 586	378 462	377 861	369 184
Sum emissions from industries	237 614	259 244	273 726	286 538	302 369	304 217	301 741
01	3 592	3 527	3 815	3 617	1 803	2 220	2 269
02	697	659	671	766	774	763	766
05	756	742	732	760	768	840	880
10	26	3	7	12	9	10	5
11	141 822	160 861	176 802	186 011	203 367	206 094	204 194
13	142	123	156	36	30	32	19
14	95	72	78	244	241	237	226
15	1 215	1 225	1 179	1 205	1 069	1 173	1 077
16	22	19	19	20	20	14	9
17	11	7	9	16	12	14	12
18	2	1	1	2	2	3	3
19	497	542	131	261	103	236	155
20	2 225	2 218	1 518	1 859	1 372	1 736	1 632
21	702	690	185	246	237	290	335
22	5 037	5 340	5 168	5 705	6 204	5 968	6 177
23	14 568	17 164	17 556	19 255	19 764	16 062	17 627
24	4 432	3 738	7 861	6 600	8 236	7 890	6 700
25	1 759	2 226	1 015	1 019	1 028	930	1 057
261	10	10	8	7	6	8	21
269	786	1 026	830	1 090	1 249	1 636	1 457
271	1 538	1 554	1 133	1 387	1 412	1 496	1 458
279	94	33	32	59	51	49	47
28	1 021	942	780	926	711	776	797
29	1 618	1 483	227	235	144	200	212
30	3	2	2	1	1	0	0
31	256	240	81	100	76	74	73
32	12	5	3	4	3	3	2
33	2	2	6	7	5	7	8
34	3	2	3	6	6	11	14
35	923	930	813	956	722	789	768
36	132	100	1 016	1 101	953	992	973
37	0	0	0	2	1	2	5
401	165	176	182	146	137	92	81
403	319	336	340	353	371	376	379
41	0	35	34	29	16	16	15
45	12 437	11 978	11 930	13 504	12 647	12 744	13 003
50	11 638	11 979	12 199	11 653	11 498	11 117	11 111
55	101	104	113	101	101	98	90
601	117	124	130	134	131	90	95
602	4 331	4 596	5 019	4 630	4 823	5 149	5 038
603	1	1	1	1	1	2	2
611	9 409	8 434	7 275	7 429	8 232	9 412	8 886
619	1 406	1 460	1 462	1 571	1 499	1 570	1 663
62	1 585	2 143	1 780	2 241	1 918	2 130	2 052
63	4 638	4 513	4 402	4 128	4 084	3 849	4 643
64	1 337	1 348	1 420	1 275	1 176	1 055	997
65	521	505	529	464	437	387	347
70	2 143	2 452	1 425	1 338	1 850	1 959	1 440
75	1 259	1 221	985	1 298	1 179	1 148	1099
80	315	295	250	212	182	167	135
85	1 072	1 326	1 775	2 034	1 206	1 942	1 339
90	70	75	79	50	50	14	13
91	2	3	5	5	4	4	3
92	15	13	9	14	15	13	14
93	735	641	545	413	433	328	318
Sum household emissions	81 516	80 871	80 702	79 048	76 093	73 644	67 443
991	56 767	55 917	54 093	51 540	48 169	44 883	37 253
992	7 755	7 485	8 844	9 329	9 008	9 519	10 599
993	16 993	17 469	17 764	18 179	18 916	19 242	19 591

Table A.6 Emissions to air of CH_4 for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	322 691	328 345	333 416	340 820	343 866	346 303	352 019
Sum emissions from industries	314 310	320 163	324 223	331 310	334 663	336 751	341 869
01	102 674	104 584	103 040	106 912	107 614	108 117	108 013
02	12	11	12	13	13	13	13
05	103	98	96	101	102	113	119
10	4 619	5 025	3 747	4 217	4 090	3 215	5 411
11	19 118	22 897	26 294	27 209	27 633	27 411	31 174
13	3	2	2	2	2	2	1
14	5	5	5	6	6	5	5
15	24	23	23	28	26	28	24
16	1	1	1	1	2	1	1
17	1	1	1	1	1	2	1
20	16 900	17 347	17 715	18 103	18 112	17 764	17 172
21	12 387	12 702	12 966	13 274	13 286	13 017	12 592
22	4	3	3	3	3	3	2
23	63	80	81	80	68	76	79
24	919	884	967	1 075	1 067	1 054	1 051
25	1	1	1	1	1	1	1
261	3	3	3	3	3	3	4
269	11	12	13	15	17	20	20
271	1	1	1	1	1	1	1
279	10	7	6	8	7	8	9
28	3	3	3	3	3	3	3
29	3	2	3	3	3	3	3
31	1	1	2	2	2	2	2
32	1	0	0	0	0	0	0
34	0	0	1	1	1	2	2
35	3	5	3	4	3	3	2
36	3	2	2	2	2	6	4
37	0	0	0	1	0	0	0
401	7	7	8	6	6	4	4
403	95	94	102	105	110	110	113
41	0	3	3	1	2	2	2
45	43	43	47	49	54	52	54
50	331	337	364	322	359	364	372
55	8	8	11	5	8	13	11
601	6	7	6	6	7	5	5
602	151	157	176	154	168	180	181
603	5	5	5	5	5	6	6
611	902	808	697	712	789	902	852
619	81	85	84	85	91	97	104
62	38	39	41	43	50	51	51
63	14	12	14	12	13	14	13
64	54	54	58	53	52	49	50
65	23	23	25	20	20	21	20
70	66	69	21	21	23	26	25
75	29	33	23	18	20	26	25
80	20	18	16	11	18	27	20
85	42	42	48	38	45	51	44
90	155 493	154 591	157 460	158 553	160 722	163 847	164 180
91	2	3	5	1	4	4	3
92	2	2	1	1	1	3	3
93	25	23	17	20	28	24	22
Sum household emissions	8 381	8 182	9 193	9 510	9 203	9 552	10 150
991	2 161	2 165	2 131	2 075	2 008	1 972	1 735
992	5 935	5 732	6 777	7 149	6 902	7 286	8 121
993	284	285	285	286	293	294	295

Table A.7 Emission to air of CO for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	806 023	791 823	789 122	775 129	738 255	706 629	649 597
Sum emissions from industries	227 434	223 556	216 006	215 024	210 216	196 620	191 951
01	7 946	7 834	7 257	7 134	4 014	3 844	3 583
02	1 052	1 112	1 131	1 244	1 272	1 234	1 245
05	6 347	6 338	6 282	6 421	6 470	6 841	7 065
10	199	17	37	62	47	66	25
11	5 415	5 868	6 160	6 556	6 653	7 228	7 618
13	148	133	135	117	102	129	72
14	310	226	227	338	380	295	243
15	1 616	1 500	1 438	1 499	1 638	1 384	1 016
16	172	148	152	154	165	103	66
17	64	38	48	85	65	64	50
18	14	6	8	13	11	16	17
19	4	1	2	7	7	8	7
20	4 093	4 015	4 496	4 536	4 601	4 640	5 502
21	1 491	1 649	1 742	1 856	1 987	1 892	2 535
22	666	464	380	440	405	389	298
23	76	229	163	77	95	19	12
24	31 029	32 438	35 366	39 602	40 027	39 184	37 608
25	83	58	30	61	60	61	47
261	37	29	22	17	13	15	69
269	219	110	105	207	274	428	364
271	64	44	37	42	22	44	36
279	18 341	14 098	9 089	9 203	10 176	1 666	2 165
28	283	203	222	243	218	227	226
29	322	271	308	299	199	254	201
30	25	19	18	8	6	0	0
31	98	67	52	83	72	43	44
32	92	37	25	28	26	21	17
33	0	0	6	7	7	15	24
34	14	10	14	29	27	80	95
35	228	450	243	247	156	174	139
36	210	135	131	128	148	389	229
37	0	0	0	9	2	10	17
401	1 200	1 263	1 290	977	953	619	513
403	446	430	483	527	467	506	515
41	0	149	142	123	69	65	61
45	4 578	4 465	5 712	6 664	5 898	5 678	5 531
50	58 360	58 542	61 241	55 526	54 792	51 154	50 751
55	787	804	872	781	771	736	660
601	325	344	359	371	362	249	262
602	20 159	19 928	21 761	19 586	21 005	21 900	21 339
603	9	10	10	10	10	12	11
611	12 154	10 893	9 396	9 596	10 633	12 157	11 478
619	1 090	1 148	1 127	1 147	1 232	1 312	1 408
62	5 774	5 746	5 791	5 883	5 083	5 327	5 303
63	1 246	1 244	1 324	1 343	1 396	1 272	1161
64	10 474	10 545	11 081	9 913	9 087	8 148	7433
65	4 101	3 971	4 140	3 621	3 395	2 998	2 600
70	12 821	13 085	3 573	3 709	3 711	3 960	3 515
75	3 338	3 504	2 325	3 377	2 919	2 251	2 136
80	2 463	2 309	1 948	1 625	1 385	1 246	975
85	3 972	4 091	4 407	5 916	4 328	3 941	3 534
90	491	516	545	368	362	94	86
91	12	13	24	23	22	19	15
92	63	57	41	59	55	55	57
93	2 913	2 952	3 088	3 127	2 936	2 158	1 972
Sum household emissions	578 589	568 267	573 116	560 105	528 039	510 009	457 646
991	425 995	419 254	404 362	384 279	356 262	330 732	262 380
992	111 417	107 733	127 474	134 514	129 861	137 147	152 899
993	41 177	41 280	41 280	41 313	41 916	42 131	42 367

Table A.8 Emissions to air of CO_2 for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	46 395 087	45 757 724	45 941 979	48 129 267	49 599 218	54 011 567	53 580 671
Sum emissions from industries	40 777 662	40 423 462	40 651 541	42 841 373	44 354 061	48 420 117	48 358 213
01	751 098	735 022	684 907	714 478	636 532	686 398	628 486
02	55 766	53 277	54 224	49 638	54 032	48 018	49 787
05	1 364 738	1 282 306	1 262 845	1 324 800	1 342 604	1 498 124	1 571 883
10	25 981	25 361	17 603	21 710	21 086	15 905	24 241
11	7 845 071	8 381 038	8 969 260	9 448 957	9 629 216	10 382 225	10 867 609
13	85 497	80 921	80 267	84 079	60 062	62 541	26 126
14	96 672	84 816	97 326	124 229	125 507	98 633	99 345
15	481 788	481 335	509 420	647 775	543 650	633 714	563 509
16	3 849	4 494	4 398	4 125	3 494	4 046	2 915
17	23 163	20 895	23 140	31 261	24 901	41 775	31 064
18	1 850	1 464	1 411	3 267	2 480	3 724	3 178
19	3 225	3 763	2 913	4 806	4 224	4 791	3 664
20	81 273	58 761	58 427	67 668	76 263	91 683	65 368
21	287 167	224 366	262 857	646 453	549 493	781 203	587 489
22	36 296	32 179	45 438	39 033	42 435	37 159	35 539
23	1 654 201	2 086 807	2 108 192	2 073 166	1 793 620	1 981 258	2 068 663
24	1 802 229	1 719 363	2 610 955	2 701 556	2 723 360	2 832 604	3 090 529
25	27 904	24 064	25 767	28 088	27 991	32 083	27 275
261	64 841	68 903	64 461	73 450	70 094	91 862	98 227
269	1 098 788	1 187 341	1 523 091	1 583 477	1 670 211	1 722 146	1 826 043
271	2 826 014	2 708 624	2 361 417	2 767 421	2 960 282	3 012 107	2 955 232
279	2 028 748	1 923 055	1 762 994	1 954 193	1 921 092	1 989 252	2 073 184
28	54 072	56 089	59 870	59 758	59 366	57 897	51 127
29	51 702	35 712	49 142	51 653	49 257	62 373	59 134
30	444	562	714	113	99	63	0
31	13 254	12 182	42 180	55 473	48 495	52 771	49 892
32	2 272	2 018	1 599	1 911	662	780	764
33	177	130	575	578	514	717	857
34	8 402	11 926	12 823	15 487	22 441	21 325	27 681
35	66 155	73 977	60 991	76 503	60 053	55 486	49 604
36	18 652	18 402	22 944	24 193	23 956	28 070	25 675
37	0	0	0	13 337	8 549	9 030	12 000
401	33 455	38 164	43 671	44 396	34 583	33 668	28 373
403	178 703	169 234	171 359	209 349	209 593	303 691	258 857
41	0	35 460	35 460	32 790	26 844	26 400	25 404
45	515 689	525 464	482 882	567 970	631 270	616 022	664 511
50	1 120 033	1 110 102	1 195 038	1 186 738	1 266 687	1 335 031	1 340 556
55	37 872	41 123	58 433	27 451	40 447	77 665	64 664
601	99 538	105 425	107 320	114 402	109 270	79 288	81 938
602	1 858 407	2 106 184	2 601 312	2 262 004	2 553 135	2 868 319	2 885 885
603	12 554	13 247	13 389	14 552	13 979	16 422	15 652
611	12 492 429	11 199 351	9 659 685	9 865 463	10 929 542	12 496 820	11 795 218
619	1 117 165	1 176 170	1 154 830	1 175 299	1 261 419	1 343 896	1 442 325
62	992 016	1 029 554	1 093 031	1 119 337	1 336 482	1 333 357	1 343 690
63	130 462	112 109	122 250	112 244	100 823	112 250	112 462
64	125 647	114 804	123 583	121 535	118 853	118 982	127 701
65	63 342	59 251	67 481	59 336	46 485	66 650	61 540
70	153 778	157 212	64 616	70 033	85 502	97 112	98 610
75	449 580	529 589	379 965	519 804	464 062	450 814	457 281
80	85 599	71 321	69 192	105 427	100 827	173 693	124 634
85	222 137	213 712	254 300	276 285	216 206	279 639	222 189
90	71 645	72 741	75 834	69 675	67 668	63 972	66 572
91	19 020	20 288	38 173	36 011	34 248	29 665	24 293
92	23 913	22 534	14 481	18 735	19 421	31 686	29 239
93	113 389	101 270	43 105	139 901	130 694	125 312	110 529
Sum household emissions	5 617 425	5 334 262	5 290 438	5 287 894	5 245 157	5 591 450	5 222 458
991	4 213 280	4 109 907	4 106 150	4 113 616	4 046 240	4 146 316	3 975 085
992	1 162 478	980 960	939 778	928 448	948 350	1 193 330	994 201
993	241 667	243 395	244 510	245 830	250 568	251 805	253 172

Table A.9 Emissions to air of NH_3 for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	24 035,4	25 032,3	24 895,9	24 980,2	25 978,5	26 543,0	26 348,4
Sum emissions from industries	23 800,3	24 759,1	24 539,5	24 519,6	25 403,5	25 815,6	25 495,6
01	23 392,0	24 323,3	24 116,8	24 080,2	24 886,8	25 279,1	24 875,9
02	0,1	0,1	0,1	0,1	0,1	0,1	0,1
05	0,0	0,1	0,2	0,2	0,3	0,4	0,7
10	0,1	0,0	0,0	0,0	0,0	0,1	0,0
11	0,0	0,0	0,0	0,0	0,0	0,0	0,0
13	0,1	0,1	0,1	0,1	0,1	0,2	0,1
14	0,1	0,1	0,1	0,1	0,2	0,2	0,1
15	0,7	0,7	0,9	1,1	1,8	1,9	1,8
16	0,1	0,1	0,1	0,2	0,2	0,2	0,2
17	0,0	0,0	0,0	0,1	0,1	0,1	0,1
20	0,1	0,1	0,1	0,1	0,1	0,1	0,2
21	0,0	0,0	0,0	0,1	0,1	0,2	0,1
22	0,4	0,3	0,3	0,5	0,6	0,9	1,0
23	0,0	0,1	0,0	0,0	0,0	0,0	0,0
24	337,1	353,1	316,1	303,1	340,3	312,4	318,3
25	0,0	0,0	0,0	0,0	0,1	0,1	0,1
269	0,1	0,0	0,0	0,1	0,1	0,2	0,1
279	0,1	0,0	0,0	0,0	0,1	0,1	0,1
28	0,1	0,1	0,2	0,2	0,3	0,4	0,5
29	0,2	0,2	0,2	0,3	0,2	0,4	0,5
31	0,0	0,0	0,0	0,1	0,1	0,0	0,1
32	0,1	0,0	0,0	0,0	0,0	0,0	0,1
33	0,0	0,0	0,0	0,0	0,0	0,0	0,1
35	0,1	0,3	0,2	0,2	0,2	0,3	0,3
36	0,1	0,1	0,1	0,1	0,1	0,1	0,2
37	0,0	0,0	0,0	0,0	0,0	0,0	0,0
401	0,6	0,8	1,1	1,1	1,5	1,3	1,5
45	1,9	2,0	3,8	5,9	6,2	7,7	10,3
50	35,6	42,3	60,2	74,5	99,5	127,9	170,2
55	0,4	0,5	0,8	0,9	1,3	1,6	2,1
601	0,0	0,0	0,0	0,0	0,0	0,0	0,0
602	7,9	8,3	10,5	13,5	18,7	25,6	38,6
63	0,6	0,7	1,1	1,5	2,1	2,6	3,6
64	5,9	7,0	10,0	12,1	15,1	18,5	25,4
65	2,3	2,6	3,7	4,4	5,6	6,8	8,9
70	7,2	8,7	3,1	4,5	5,9	8,8	11,6
75	0,9	1,0	0,9	1,1	1,1	1,1	1,1
80	1,4	1,5	1,7	1,9	2,2	2,6	3,1
85	2,2	2,7	3,9	7,1	7,0	8,7	11,8
90	0,2	0,3	0,4	0,4	0,6	0,2	0,2
93	1,6	1,9	2,8	3,8	4,8	4,7	6,5
Sum household emissions	235,1	273,2	356,4	460,6	575,0	727,4	852,8
991	235,0	273,1	356,4	460,5	574,9	727,2	852,6
993	0,1	0,1	0,1	0,1	0,2	0,2	0,2

Table A.10 Emissions to air of Particulate matter for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	23 818,98	23 458,06	25 204,30	25 810,43	25 131,53	26 316,31	27 460,61
Sum emissions from industries	9 886,38	9 906,06	9 903,20	9 792,03	9 892,33	10 257,21	9 766,21
01	951,90	941,40	835,40	845,50	718,00	717,50	703,80
02	126,10	120,50	122,60	112,50	122,40	108,90	112,90
05	214,90	201,50	198,40	208,20	211,00	235,40	247,00
10	0,80	0,50	3,40	6,70	5,00	2,80	2,70
11	213,40	234,00	289,90	273,90	279,20	294,20	335,10
13	46,00	41,70	49,10	45,00	35,10	32,60	15,70
14	72,40	48,30	57,70	98,30	110,00	83,00	71,50
15	130,00	139,40	144,90	179,60	144,60	134,10	121,60
16	1,10	0,50	0,50	1,30	1,60	0,90	0,70
17	6,20	3,40	3,70	9,30	7,20	11,20	8,80
18	0,60	0,20	0,20	1,00	0,70	0,90	0,90
19	0,60	0,10	0,20	1,30	1,10	1,00	0,90
20	77,50	84,40	95,30	83,00	85,40	89,10	95,50
21	141,50	115,60	127,40	265,40	232,60	306,80	251,50
22	4,20	1,90	2,50	2,30	2,20	3,00	2,80
23	101,40	152,40	133,90	114,10	100,80	101,80	106,10
24	79,00	51,10	45,80	84,00	67,90	85,90	109,50
25	5,90	1,80	2,80	7,30	6,20	7,10	6,70
261	15,10	19,70	15,90	16,50	14,80	19,60	21,50
269	133,20	48,30	44,20	74,50	88,10	136,90	123,40
271	14,20	20,70	18,20	16,20	8,50	16,40	10,90
279	93,30	44,80	52,60	75,40	67,70	63,80	51,30
28	10,00	4,10	11,10	12,10	11,00	11,90	12,40
29	11,20	4,00	4,60	14,20	11,50	12,50	13,50
30	0,10	0,00	0,10	0,00	0,00	0,00	0,00
31	4,10	1,30	10,30	16,90	13,90	15,20	14,70
32	0,60	0,10	0,10	0,60	0,10	0,20	0,20
33	0,10	0,00	0,20	0,10	0,10	0,20	0,20
34	1,30	1,00	1,00	3,70	3,00	3,90	5,80
35	10,70	17,50	17,10	18,80	12,90	11,80	11,40
36	6,20	3,50	3,10	6,60	6,20	10,70	8,20
37	0,00	0,00	0,00	1,60	0,60	1,30	3,20
401	20,90	26,00	28,80	33,20	21,80	18,10	17,90
403	154,30	154,30	149,80	167,70	169,20	166,10	150,80
41	0,00	30,30	28,90	25,50	13,20	11,90	10,90
45	577,50	596,80	526,30	605,30	653,70	647,30	682,30
50	669,28	662,56	627,80	614,13	603,23	585,71	551,71
55	2,50	2,60	3,50	1,90	2,40	4,20	3,70
601	110,90	117,60	123,10	126,60	124,20	84,60	89,30
602	2 927,40	3 265,90	3 707,50	3 145,30	3 212,40	3 214,70	2 896,40
603	0,00	0,00	0,00	0,00	0,00	0,00	0,00
611	2 352,30	2 108,40	1 818,60	1 857,30	2 058,10	2 353,00	2 221,50
619	210,90	222,10	218,20	222,00	238,40	254,00	272,60
62	125,70	130,30	138,50	141,70	169,30	168,90	171,00
63	33,20	29,70	29,80	30,60	28,50	27,20	25,80
64	60,20	59,30	56,30	54,70	51,80	49,20	46,60
65	6,50	5,90	6,30	5,40	4,40	4,90	4,40
70	31,50	31,00	25,40	26,30	36,70	33,20	31,00
75	72,00	101,30	65,20	79,80	80,90	57,70	67,30
80	6,20	5,20	4,80	6,20	5,80	9,10	6,70
85	15,90	14,20	15,40	18,60	13,20	15,60	13,00
90	16,50	22,50	22,90	14,20	13,40	12,20	15,50
91	0,90	1,00	1,90	1,80	1,70	1,40	1,20
92	3,80	3,60	2,90	3,60	5,10	5,20	5,10
93	14,40	11,80	9,10	14,30	15,50	12,40	11,10
Sum household emissions	13 932,60	13 552,00	15 301,10	16 018,40	15 239,20	16 059,10	17 694,40
991	784,10	730,80	675,50	663,30	617,00	621,20	578,80
992	10 938,80	10 598,30	12 579,90	13 284,50	12 816,70	13 506,90	15 115,30
993	2 209,70	2 222,90	2 045,70	2 070,60	1 805,50	1 931,00	2 000,30

Table A.11 Emission to air of Lead (Pb) for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	186,33	152,34	108,45	23,67	17,47	10,66	9,15
Sum emissions from industries	48,89	39,61	29,33	10,98	9,72	8,55	7,35
01	1,25	1,02	0,71	0,13	0,04	0,03	0,02
02	0,12	0,10	0,07	0,01	0,01	0,00	0,00
05	0,37	0,36	0,27	0,08	0,07	0,06	0,07
10	0,06	0,00	0,00	0,00	0,00	0,00	0,00
11	0,04	0,04	0,05	0,04	0,04	0,04	0,05
13	0,03	0,03	0,02	0,02	0,01	0,01	0,00
14	0,02	0,02	0,01	0,01	0,01	0,01	0,01
15	0,39	0,32	0,21	0,09	0,07	0,06	0,06
16	0,05	0,04	0,03	0,00	0,00	0,00	0,00
17	0,02	0,01	0,01	0,01	0,00	0,01	0,00
20	0,04	0,03	0,01	0,01	0,01	0,01	0,01
21	0,08	0,07	0,08	0,19	0,16	0,22	0,17
22	0,20	0,12	0,07	0,01	0,01	0,00	0,00
23	0,02	0,02	0,01	0,01	0,00	0,00	0,00
24	0,13	0,06	0,05	0,06	0,04	0,06	0,08
25	0,02	0,01	0,01	0,00	0,00	0,00	0,00
261	1,29	1,28	1,27	1,16	1,35	1,38	1,01
269	0,05	0,04	0,06	0,07	0,07	0,08	0,09
271	0,28	0,28	0,13	0,11	0,13	0,07	0,09
279	0,51	0,50	0,50	0,51	0,50	0,45	0,43
28	0,07	0,05	0,03	0,01	0,00	0,00	0,00
29	0,09	0,06	0,05	0,01	0,00	0,00	0,00
30	0,01	0,01	0,00	0,00	0,00	0,00	0,00
31	0,02	0,02	0,02	0,01	0,01	0,01	0,01
32	0,03	0,01	0,00	0,00	0,00	0,00	0,00
35	0,06	0,10	0,03	0,01	0,01	0,00	0,00
36	0,03	0,02	0,02	0,00	0,00	0,00	0,00
37	2,00	0,00	0,00	0,00	0,00	0,00	0,00
401	0,35	0,30	0,22	0,03	0,02	0,00	0,00
403	1,27	1,25	1,25	1,31	1,31	1,21	1,27
45	0,78	0,61	0,72	0,16	0,09	0,04	0,04
50	19,31	16,16	12,38	1,92	1,25	0,37	0,36
55	0,24	0,21	0,16	0,03	0,02	0,01	0,01
602	2,93	2,01	1,39	0,33	0,27	0,16	0,17
611	2,35	2,18	1,86	1,92	2,06	2,39	2,14
619	0,08	0,07	0,06	0,05	0,06	0,06	0,07
62	1,88	1,78	1,70	1,66	1,51	1,62	1,00
63	0,34	0,29	0,23	0,04	0,03	0,01	0,01
64	3,26	2,73	2,09	0,32	0,19	0,05	0,05
65	1,28	1,03	0,79	0,12	0,07	0,02	0,02
70	4,00	3,40	0,66	0,12	0,07	0,02	0,02
75	0,49	0,39	0,19	0,05	0,03	0,02	0,02
80	0,76	0,60	0,37	0,05	0,03	0,01	0,01
85	1,22	1,05	0,82	0,20	0,10	0,04	0,04
90	0,17	0,17	0,14	0,01	0,01	0,00	0,00
93	0,90	0,76	0,58	0,10	0,06	0,02	0,02
Sum household emissions	137,44	112,73	79,12	12,69	7,75	2,11	1,80
991	131,60	107,81	75,65	12,11	7,36	1,97	1,68
992	0,04	0,04	0,04	0,04	0,04	0,05	0,04
993	5,79	4,88	3,43	0,55	0,35	0,09	0,08

Table A.12 Emission to air of Cadmium (Cd) for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	1.2205	1.1151	1.1463	0.6512	0.6676	0.6696	0.6630
Sum emissions from industries	1.1089	1.0074	1.0189	0.5168	0.5378	0.5327	0.5100
01	0.0023	0.0019	0.0015	0.0015	0.0012	0.0012	0.0010
02	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0
05	0.0032	0.0029	0.0028	0.0029	0.0030	0.0033	0.0030
11	0.0015	0.0015	0.0019	0.0015	0.0016	0.0016	0.0020
13	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003	0
14	0.0002	0.0002	0.0003	0.0004	0.0004	0.0003	0
15	0.0028	0.0019	0.0016	0.0020	0.0016	0.0019	0.0020
16	0.0001	0.0001	0.0001	0.0001	0.0003	0	0
17	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0
20	0.0263	0.0255	0.0287	0.0294	0.0298	0.0303	0.0360
21	0.0156	0.0147	0.0155	0.0191	0.0189	0.0196	0.0230
22	0.0001	0.0001	0.0001	0.0001	0.0001	0	0
23	0.0003	0.0004	0.0002	0.0002	0.0001	0	0
24	0.0024	0.0012	0.0031	0.0035	0.0030	0.0034	0.0040
25	0.0001	0	0.0001	0.0001	0.0001	0.0001	0
261	0.0003	0.0003	0.0004	0.0005	0.0005	0.0006	0.0010
269	0.0375	0.0411	0.0552	0.0609	0.0614	0.0608	0.0660
271	0.0069	0.0069	0.0049	0.0051	0.0052	0.0053	0.0050
279	0.8010	0.8008	0.8008	0.3029	0.3028	0.2528	0.2530
28	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0
29	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0
31	0	0	0.0003	0.0004	0.0004	0.0005	0
34	0	0	0	0	0	0.0004	0
35	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0
36	0.0007	0.0003	0.0003	0.0003	0.0003	0.0021	0.0010
37	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070	0.0070
401	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0
403	0.1262	0.0305	0.0308	0.0208	0.0371	0.0694	0.0420
41	0	0.0001	0.0001	0.0001	0.0001	0.0001	0
45	0.0010	0.0010	0.0009	0.0011	0.0018	0.0018	0.0020
50	0.0012	0.0011	0.0011	0.0013	0.0013	0.0015	0.0010
55	0.0001	0.0001	0.0001	0	0.0001	0.0002	0
601	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0
602	0.0039	0.0045	0.0056	0.0048	0.0054	0.0061	0.0060
611	0.0553	0.0507	0.0434	0.0446	0.0484	0.0558	0.0510
619	0.0031	0.0031	0.0029	0.0029	0.0032	0.0033	0.0040
63	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0
64	0.0001	0	0	0	0	0	0
65	0.0001	0	0.0001	0.0001	0	0.0001	0
70	0.0001	0.0001	0	0	0	0	0
75	0.0004	0.0006	0.0004	0.0004	0.0004	0.0005	0
80	0.0001	0.0001	0.0001	0.0002	0.0002	0.0004	0
85	0.0005	0.0004	0.0005	0.0005	0.0004	0.0005	0
90	0.0067	0.0065	0.0064	0	0	0	0
91	0	0	0.0001	0.0001	0.0001	0.0001	0
92	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0
93	0.0002	0.0002	0	0.0003	0.0002	0.0002	0
Sum household emissions	0.1116	0.1077	0.1274	0.1344	0.1298	0.1369	0.153
991	0.0003	0.0003	0.0003	0.0004	0.0004	0.0005	0.001
992	0.1112	0.1073	0.127	0.134	0.1293	0.1363	0.152
993	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0

Table A.13 Energy consumption by industry for Norway 1991-1997. PetaJoule.

Industry code	1991	1992	1993	1994	1995	1996	1997
Total energy consumption incl. households	1048,3	1041,2	1057,6	1095,9	1123,0	1178,3	1194,2
01	10.2	10.1	12.3	12.9	11.2	11.2	10.2
02	0.8	0.7	0.7	0.7	0.7	0.7	0.7
05	18.4	17.3	17.2	18.1	18.4	20.5	21.6
10	0.3	0.2	0.2	0.2	0.2	0.2	0.2
11	125.4	131.5	141.1	152.3	156.0	168.3	172.8
13	2.9	2.7	2.6	2.5	1.7	2.0	1.1
14	2.1	1.9	2.2	2.6	2.6	2.2	2.4
15	15.6	17.3	18.1	18.8	18.1	17.7	17.5
16	0.2	0.1	0.1	0.1	0.2	0.1	0.1
17	0.9	0.9	0.9	1.1	1.0	1.1	1.1
18	0.1	0.1	0.1	0.1	0.1	0.2	0.1
19	0.1	0.1	0.1	0.1	0.1	0.1	0.1
20	8.1	7.6	8.5	9.0	9.0	8.7	9.4
21	38.1	35.9	39.6	42.9	44.1	45.2	43.1
22	1.8	1.8	2.1	2.0	2.0	2.0	1.9
23	36.3	44.0	38.6	37.5	32.9	36.1	37.5
24	71.3	69.4	85.3	85.6	84.1	86.4	102.4
25	2.1	1.8	1.8	2.0	1.9	1.7	1.6
261	1.5	1.5	1.5	1.7	1.7	2.0	2.0
269	8.2	9.1	12.9	14.2	15.3	16.0	16.9
271	50.9	50.3	42.2	48.7	52.0	51.0	49.8
279	72.7	68.8	69.7	72.7	74.1	68.5	73.6
28	2.7	3.2	3.5	2.7	3.2	2.6	2.6
29	2.5	2.3	2.9	2.9	3.1	2.9	3.2
30	0.1	0.1	0.0	0.1	0.1	0.0	0.0
31	1.1	1.2	5.5	5.9	5.6	5.9	6.0
32	0.3	0.3	0.3	0.3	0.2	0.2	0.2
33	0.0	0.0	0.3	0.3	0.3	0.3	0.3
34	0.7	0.8	0.9	0.8	0.9	1.1	1.2
35	2.8	3.2	2.9	3.4	3.3	3.1	3.2
36	1.2	1.2	1.2	1.3	1.4	1.7	1.6
37	0.0	0.0	0.1	0.3	0.2	0.2	0.3
401	6.1	6.0	5.7	8.6	7.5	4.1	8.5
403	6.7	6.6	6.8	7.7	8.3	8.7	7.5
41	0.0	0.5	0.5	0.4	0.4	0.4	0.3
45	8.5	8.2	7.5	8.8	9.9	10.6	11.0
50	32.3	30.0	34.3	32.7	33.4	35.6	36.9
55	5.3	5.3	5.2	5.0	5.0	5.8	5.9
601	3.1	3.2	3.3	3.4	3.4	2.9	2.9
602	25.8	29.3	35.7	31.1	35.1	39.4	39.7
603	0.0	0.0	0.0	0.0	0.0	0.0	0.0
611	163.6	146.5	126.4	129.0	143.2	163.6	154.8
619	15.1	15.9	15.6	15.9	17.1	18.2	19.6
62	17.6	18.2	20.2	19.8	24.9	23.4	23.3
63	3.8	3.5	3.9	3.3	3.2	3.5	3.4
64	3.7	3.7	3.5	3.3	3.4	3.8	4.0
65	3.4	3.6	3.9	3.9	3.6	4.6	4.2
70	5.5	6.3	3.4	3.8	4.2	5.0	5.3
75	15.2	16.2	15.4	17.7	16.9	17.6	18.0
80	12.3	12.9	9.6	10.3	9.8	11.5	11.8
85	15.5	19.3	15.3	14.2	12.9	13.9	13.1
90	0.2	0.3	0.3	0.3	0.4	0.3	0.3
91	1.6	1.9	2.9	3.2	3.6	4.4	4.5
92	5.3	4.3	5.1	5.3	5.5	7.0	7.5
93	3.7	3.9	4.2	5.4	5.7	5.8	6.0
95	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Household consumption	214.6	210.2	213.5	219.0	219.9	228.3	221.0

Table A.14 Gross value added by industry for Norway 1991-1997 at fixed 1995-prices.
Mill kroner

Industry code	1991	1992	1993	1994	1995	1996	1997
Gross value added for industries	734678	754094	768869	803205	831067	864280	903794
01	11 974	10 840	11 983	11 258	11 794	11 949	11 575
02	3 546	3 296	3 386	3 046	3 370	2 796	3 026
05	4 259	4 355	5 831	6 932	7 944	7 754	8 255
10	69	82	31	27	34	10	77
11	75 832	84 738	87 946	100 466	109 647	122 448	130 447
13	403	453	345	521	341	277	348
14	1 193	1 203	1 076	1 279	1 481	1 629	1 687
15	15 642	16 500	16 367	16 802	17 925	16 075	15 761
16	552	419	544	532	293	289	242
17	1 403	1 481	1 468	1 504	1 327	1 540	1 542
18	440	468	492	500	527	540	499
19	154	158	180	199	181	160	171
20	5 002	4 700	4 252	4 203	4 242	4 064	4 290
21	5 891	5 675	6 262	6 981	7 223	7 250	7 930
22	10 783	10 587	11 357	11 677	11 898	11 447	11 301
23	1 630	2 023	2 294	1 617	839	1 993	998
24	9 036	9 452	9 978	10 378	10 759	11 217	11 358
25	2 231	2 233	2 272	2 417	2 318	2 350	2 517
261	694	643	587	679	653	729	757
269	2 862	2 653	2 815	3 017	3 240	3 310	3 535
271	2 069	2 193	2 104	2 324	2 405	2 268	2 890
279	7 408	8 169	8 364	8 978	7 453	8 565	9 464
28	5 180	5 147	5 043	5 267	5 726	6 194	6 568
29	7 515	7 337	6 636	7 589	8 288	8 307	9 001
30	169	193	208	312	359	406	482
31	4 166	4 134	4 136	4 210	3 896	3 654	4 068
32	1 265	1 195	1 423	1 740	2 012	2 145	2 247
33	1 667	1 757	1 809	2 036	2 179	2 093	2 487
34	960	1 027	963	1 073	1 459	1 635	1 771
35	10 656	11 107	12 675	11 981	12 315	12 227	13 467
36	3 184	3 176	2 968	3 249	3 372	3 607	4 219
37	5	8	117	225	183	202	446
401	20 166	21 328	21 904	20 848	22 757	20 651	19 873
403	142	147	50	83	148	70	67
41	1 660	1 590	1 530	1 575	1 485	1 507	1 694
45	33 749	33 734	31 345	32 653	33 537	33 709	36 425
50	80 385	82 889	82 883	91 902	94 283	102 566	108 096
55	12 614	11 296	10 507	11 291	11 263	11 632	12 516
601	2 545	3 732	2 358	2 212	2 177	2 055	2 237
602	14 569	14 591	15 160	16 484	18 077	19 506	21 367
603	8 073	9 090	8 786	10 287	11 955	14 540	17 005
611	16 571	15 790	15 614	16 237	17 073	16 919	17 613
619	2 024	1 848	1 831	1 951	1 999	1 960	1 853
62	5 517	5 604	5 484	4 594	4 982	5 769	5 243
63	10 458	10 482	12 166	12 942	14 183	14 270	14 942
64	13 320	14 659	16 167	17 887	17 675	19 207	20 570
65	42 113	41 229	40 200	37 682	36 823	36 805	36 123
70	104 599	104 715	110 380	112 233	115 748	118 193	125 409
75	43 318	45 079	46 274	46 651	46 157	46 686	47 030
80	36 608	37 691	38 080	39 007	39 323	40 235	41 027
85	64 431	66 633	68 011	68 829	70 182	73 235	75 033
90	4 766	4 618	3 788	3 866	4 330	4 212	4 054
91	3 839	3 926	4 020	4 250	4 272	4 329	4 361
92	10 844	11 478	11 920	12 176	12 286	12 183	12 531
93	3 695	3 714	3 601	3 636	3 770	4 026	4 420
95	837	832	901	914	899	885	881

Table A.15 Employed full-time equivalent man-years by industry 1991-1997. 1 000 man-years.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum	1760,1	1751,2	1752,6	1773,4	1809,6	1845,6	1898,6
01	75.9	71.3	69.4	67.7	66.4	65.0	63.7
02	6.2	6.5	6.0	5.4	5.4	5.4	5.4
05	17.8	17.3	16.7	16.9	17.2	17.2	17.0
10	0.5	0.5	0.4	0.4	0.3	0.4	0.3
11	19.6	19.9	20.9	21.0	20.8	21.2	22.0
13	1.8	1.6	1.5	1.3	1.2	1.0	0.7
14	2.8	2.6	2.8	2.8	3.0	3.0	3.2
15	46.3	46.4	47.8	49.1	49.4	50.2	50.8
16	0.7	0.7	0.6	0.6	0.5	0.5	0.5
17	5.7	5.9	5.8	5.9	5.3	5.4	5.7
18	2.1	2.1	2.0	1.9	2.5	2.5	2.3
19	0.8	0.8	0.9	0.9	0.8	0.7	0.8
20	17.1	15.0	15.0	15.8	16.0	15.8	16.6
21	11.0	10.5	10.4	10.5	10.9	10.6	10.3
22	29.3	29.1	30.0	31.3	31.6	32.4	33.5
23	1.9	1.8	1.9	2.0	1.9	1.4	1.4
24	14.6	14.7	14.8	14.7	15.3	14.9	14.7
25	5.8	5.3	5.5	5.6	5.7	6.0	6.4
261	1.6	1.5	1.5	1.6	1.5	1.8	2.0
269	7.0	6.7	6.3	6.5	6.6	7.4	7.4
271	4.8	4.6	4.4	4.4	4.4	4.4	4.3
279	11.1	10.2	11.0	11.3	11.5	11.7	11.6
28	16.0	15.5	14.4	15.4	16.4	17.2	18.7
29	22.0	22.5	22.1	23.3	23.7	24.5	26.2
30	1.2	1.1	1.1	1.1	1.0	0.8	0.9
31	10.4	10.2	9.8	9.5	10.0	10.4	10.7
32	4.9	4.2	4.4	4.7	4.9	5.4	5.6
33	4.1	4.5	5.3	5.5	6.0	6.3	6.9
34	2.9	3.1	2.8	3.1	4.3	4.5	4.5
35	34.6	34.8	37.1	36.5	36.9	36.0	38.9
36	10.8	10.6	10.4	11.4	12.2	12.6	14.2
37	0.0	0.0	0.4	0.5	0.5	0.6	0.7
401	18.8	18.9	18.8	18.8	18.9	18.6	18.0
403	0.2	0.2	0.2	0.2	0.3	0.3	0.3
41	0.8	0.8	0.9	0.9	0.9	0.9	1.2
45	116.2	110.3	100.5	102.4	106.5	109.4	118.5
50	253.0	248.7	243.1	247.4	259.2	266.2	272.9
55	43.8	43.9	43.2	45.4	46.0	47.2	48.9
601	10.1	10.3	10.2	10.2	10.5	10.0	9.6
602	39.9	38.7	39.0	39.7	40.4	41.1	41.9
603	0.3	0.4	0.4	0.4	0.4	0.2	0.3
611	44.6	43.9	42.5	41.6	40.8	40.8	41.3
619	8.6	8.3	8.4	8.5	8.6	8.7	8.7
62	11.1	10.8	10.7	11.2	10.1	10.7	11.3
63	22.0	21.9	20.9	21.2	22.0	22.6	23.4
64	42.0	41.2	40.6	40.9	41.9	42.8	43.7
65	54.1	51.8	50.2	47.6	47.7	46.9	46.5
70	103.2	104.4	109.3	113.2	117.7	122.3	134.1
75	155.0	157.4	162.1	159.5	157.4	158.3	156.6
80	128.6	131.5	132.4	134.6	136.3	139.3	141.5
85	247.4	256.3	264.9	268.0	276.5	287.5	296.5
90	5.4	5.5	5.1	5.5	5.5	5.3	5.3
91	15.1	15.1	15.5	16.3	16.4	16.7	16.9
92	26.5	27.5	28.1	28.7	28.6	29.4	29.8
93	17.8	17.7	17.7	18.0	18.3	18.7	19.0
95	4.3	4.2	4.5	4.6	4.6	4.5	4.5

Table A.16 Emissions to air of SF_6 for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Total emissions for industry	86.4	28.9	30.2	35.4	23.6	22.1	22.8
279	84.5	26.7	27.8	33	21.2	19.7	18.3
31	0.1727	0.2	0.2182	0.2182	0.2182	0.2182	1.9
401	1.7273	2	2.1818	2.1818	2.1818	2.1818	2.6
Household emissions	0	0	0	0	0	0	0

Table A.17 Emissions to air of HFC-23 for Norway 1994-1997 by detailed industry. Tonnes.

Industry code	1994	1995	1996	1997
Sum emissions from industries	0,0005	0,0025	0,0086	0,0364
02	0	0	0	0.0009
05	0	0.0001	0.0004	0.0019
11	0	0	0.0001	0.0006
15	0.0001	0.0002	0.0007	0.0026
28	0.0001	0.0006	0.0020	0.0086
29	0	0.0001	0.0002	0.0008
32	0	0	0	0.0012
45	0	0	0	0.0010
50	0	0.0002	0.0005	0.0020
55	0	0.0001	0.0005	0
602	0	0	0.0001	0.0015
619	0	0	0.0001	0.0006
63	0	0.0001	0.0003	0
60	0	0	0	0.0002
70	0	0	0	0.0072
75	0	0	0	0.0072
92	0.0003	0.0011	0.0037	0.0001
Household emissions	0	0	0	0

Table A.18 Emissions to air of HFC-32 for Norway 1994-1997 by detailed industry. Tonnes

Industry code	1994	1995	1996	1997
Sum emissions from industries	0,0027	0,01	0,0283	0,1485
05	0.0002	0.0005	0.0014	0.0063
11	0	0.0001	0.0004	0.0016
15	0.0002	0.0008	0.0023	0.01
28	0.0005	0.0017	0.0046	0.0395
29	0	0.0002	0.0005	0.0039
51	0.0001	0.0004	0.0011	0.0095
55	0.0002	0.0007	0.002	0.0088
601	0	0	0.0001	0.0001
602	0.0001	0.0002	0.0006	0.0021
619	0	0.0002	0.0004	0.0017
62	0	0	0.0001	0.0001
63	0.0001	0.0004	0.0012	0.0049
70	0	0.0001	0.0006	0.0032
75	0	0.0001	0.0003	0.0011
85	0	0	0.0001	0.0007
92	0.0013	0.0046	0.0126	0.055
Household emissions	0	0	0	0

Table A.19 Emissions to air of HFC-125 for Norway 1994-1997 by detailed industry. Tonnes.

Industry code	1994	1995	1996	1997
Sum emissions from industry	0,4725	2,3755	5,4734	9,6973
01	0	0	0	0.0006
02	0	0	0	0.0003
05	0.0264	0.1330	0.3064	0.5456
11	0.0066	0.0333	0.0767	0.1367
13	0	0	0	0.0001
14	0	0	0	0.0001
15	0.0419	0.2108	0.4858	0.8653
16	0	0	0	0.0001
17	0	0	0	0.0001
18	0	0	0	0.0001
19	0	0	0	0.0001
20	0	0	0	0.0006
21	0	0	0	0.0004
22	0	0	0	0.0004
23	0	0	0	0.0003
24	0	0	0	0.0010
25	0	0	0	0.0001
26	0	0	0	0.0006
27	0	0	0	0.0006
28	0.0503	0.2530	0.5830	0.9154
29	0.0053	0.0267	0.0614	0.1099
30	0	0	0	0.0001
31	0	0	0	0.0004
32	0	0	0	0.0003
33	0.1100	0.5534	1.2752	0.0003
34	0	0	0	0.0001
35	0	0	0	0.0007
36	0	0	0	0.0004
37	0	0	0	0.0003
40	0	0	0	0.0006
45	0.1131	0.5687	1.3105	0.0007
50	0.0002	0.0006	0.0012	0.7002
55	0.0183	0.0919	0.2117	0.6444
60	0	0	0	0.0085
601	0.0160	0.0804	0.1852	0.0292
602	0.0323	0.1626	0.3748	0.2244
603	0	0	0	0.0006
611	0	0	0	0.0019
619	0	0.0001	0.0003	0.2225
62	0.0099	0.0498	0.1147	0.0006
63	0.0198	0.0998	0.2299	0.3939
64	0	0	0	0.0013
65	0.0004	0.0021	0.0048	0.0104
70	0.0123	0.0613	0.1413	0.0830
75	0.0012	0.0061	0.0141	0.0337
80	0.0004	0.0021	0.0048	0.0153
85	0.0021	0.0104	0.0240	0.0560
90	0.0004	0.0018	0.0041	0.0075
91	0.0004	0.0018	0.0041	0.0122
92	0.0048	0.0240	0.0553	4.6620
93	0.0004	0.0018	0.0041	0.0074
Household emission	0	0	0	0

Table A.20 Emissions to air of HFC-134 for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Total emissions including households	0,0433	0,1904	1,8284	5,6575	10,7927	18,9265	20,6164
Sum emissions from industries	0,0433	0,1865	1,7715	5,4209	10,1733	17,1515	20,6164
01	0.0004	0.0017	0.0163	0.0499	0.0937	0.1579	0.2424
02	0.0004	0.0017	0.0163	0.0499	0.0937	0.1579	0.2398
05	0.0016	0.0069	0.0652	0.1994	0.3742	0.6309	0.8178
11	0.0004	0.0017	0.0164	0.0500	0.0939	0.1583	0.2065
13	0	0	0	0	0	0	0.0013
14	0	0	0	0	0	0	0.0013
15	0.0028	0.0119	0.1133	0.3467	0.6506	1.0969	1.4871
16	0	0	0	0	0	0	0.0013
17	0	0	0	0	0	0	0.0013
18	0	0	0	0	0	0	0.0013
19	0	0	0	0	0	0	0.0013
20	0	0	0	0	0	0	0.0039
21	0	0	0	0	0	0	0.0039
22	0	0	0	0	0	0	0.0039
23	0	0	0	0	0	0	0.0026
24	0	0.0001	0.0008	0.0025	0.0046	0.0078	0.0185
25	0.0002	0.0007	0.0063	0.0194	0.0364	0.0613	0.0735
26	0	0	0	0	0	0	0.2163
271	0.0004	0.0017	0.0159	0.0488	0.0915	0.1543	0.0541
279	0.0004	0.0017	0.0159	0.0488	0.0915	0.1543	0.1622
28	0.0029	0.0124	0.1174	0.3594	0.6745	1.1373	1.3763
29	0.0002	0.0010	0.0099	0.0303	0.0569	0.0958	0.2161
30	0	0	0	0	0	0	0.0013
31	0	0	0	0	0	0	0.0039
32	0	0	0.0001	0.0002	0.0003	0.0006	0.0026
33	0.0015	0.0065	0.0614	0.1879	0.3527	0.5946	0.0026
34	0.0005	0.0021	0.0199	0.0608	0.1140	0.1923	0.2262
35	0	0	0	0	0	0	0.0065
36	0	0	0	0	0	0	0.0039
37	0	0	0	0	0	0	0.0026
40	0	0	0	0	0	0	0.0052
41	0	0	0	0	0	0	0.0015
45	0.0013	0.0055	0.0524	0.1603	0.3007	0.5070	0.4287
50	0.0067	0.0293	0.2783	0.8517	1.5983	2.6947	1.6881
55	0.0027	0.0116	0.1103	0.3376	0.6336	1.0682	1.6029
60	0	0	0	0	0	0	0.6074
601	0.0013	0.0054	0.0514	0.1571	0.2950	0.4973	0.1135
602	0.0025	0.0107	0.1016	0.3107	0.5831	0.9831	1.4100
603	0	0	0	0	0	0	0.0237
611	0	0	0	0	0	0	0.0710
619	0.0007	0.0029	0.0276	0.0846	0.1587	0.2676	0.3898
62	0.0001	0.0003	0.0033	0.0100	0.0188	0.0318	0.0507
63	0.0013	0.0056	0.0536	0.1641	0.3079	0.5191	0.6346
64	0	0	0	0	0	0	0.0473
65	0	0.0001	0.0010	0.0031	0.0059	0.0099	0.1791
70	0.0007	0.0029	0.0274	0.0838	0.1575	0.2655	0.6616
75	0.0004	0.0016	0.0150	0.0458	0.0860	0.1449	0.1028
80	0	0.0001	0.0011	0.0034	0.0065	0.0109	0.0217
85	0.0001	0.0006	0.0055	0.0169	0.0316	0.0533	0.0656
90	0	0.0001	0.0009	0.0028	0.0053	0.0089	0.0128
91	0	0.0001	0.0009	0.0028	0.0053	0.0089	0.0585
92	0.0138	0.0595	0.5652	1.7294	3.2453	5.4713	7.0455
93	0	0.0001	0.0009	0.0028	0.0053	0.0089	0.0121
Sum household emission	0	0.0039	0.0569	0.2366	0.6194	1.775	0

Table A.21 Emissions to air of HFC-143a for Norway 1994-1997 by detailed industry. Tonnes.

Industry code	1994	1995	1996	1997
Sum emissions from industries	0,1848	1,5093	3,8521	6,8343
01	0	0	0	0.0001
05	0.0103	0.0846	0.2154	0.3803
11	0.0026	0.0212	0.0539	0.0952
15	0.0164	0.1342	0.3415	0.6031
20	0	0	0	0.0001
24	0	0	0	0.0001
26	0	0	0	0.0001
27	0	0	0	0.0001
28	0.0189	0.1546	0.3933	0.6579
29	0.0019	0.0155	0.0393	0.0658
35	0	0	0	0.0001
40	0	0	0	0.0001
45	0	0	0	0.0001
50	0.0133	0.1088	0.2769	0.4939
55	0.0124	0.1013	0.2578	0.4543
601	0.0008	0.0018	0.0161	0.0299
602	0.0044	0.0363	0.0924	0.186
603	0	0	0	0.0013
611	0	0	0	0.0011
619	0.0044	0.0361	0.0918	0.181
62	0	0.0001	0.0002	0.0004
63	0.0074	0.061	0.1553	0.2747
64	0	0	0	0.0007
65	0.0002	0.0013	0.0033	0.0085
70	0.0012	0.0098	0.0251	0.0571
75	0.0008	0.0066	0.0169	0.0237
80	0.0002	0.0013	0.0033	0.0106
85	0.0008	0.0066	0.0167	0.0388
90	0.0001	0.0009	0.0022	0.0051
91	0.0001	0.0009	0.0022	0.0085
92	0.0885	0.7255	1.8463	3.2505
93	0.0001	0.0009	0.0022	0.0051
Household emissions	0	0	0	0

Table A.22 Emissions to air of HFC-152 for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions including households	0,4328	0,6978	0,8443	0,8702	1,0577	1,5800	2,5679
Sum emissions from industries	0,4328	0,6978	0,8443	0,8702	1,0577	1,5710	2,5679
05	0.0214	0.0346	0.0418	0.0431	0.0524	0.0779	0.0818
11	0.0054	0.0086	0.0105	0.0108	0.0131	0.0195	0.0204
15	0.0341	0.0550	0.0665	0.0686	0.0834	0.1238	0.1463
25	0.0084	0.0135	0.0163	0.0168	0.0205	0.0304	0.1045
28	0.0386	0.0623	0.0753	0.0776	0.0944	0.1402	0.4452
29	0.0003	0.0006	0.0007	0.0007	0.0008	0.0013	0.0006
33	0.0002	0.0003	0.0003	0.0003	0.0004	0.0006	0.0189
34	0.0251	0.0405	0.0490	0.0505	0.0614	0.0911	0.3135
50	0.0550	0.0884	0.1072	0.1104	0.1342	0.1994	0.3094
55	0.0255	0.0412	0.0498	0.0513	0.0624	0.0927	0.2045
601	0.0005	0.0008	0.0010	0.0010	0.0012	0.0018	0.0183
602	0.0058	0.0093	0.0112	0.0116	0.0141	0.0209	0.0662
619	0.0056	0.0090	0.0109	0.0113	0.0137	0.0203	0.0475
63	0.0154	0.0248	0.0300	0.0310	0.0376	0.0559	0.0587
65	0.0003	0.0005	0.0007	0.0007	0.0008	0.0012	0.0013
70	0.0024	0.0039	0.0047	0.0048	0.0059	0.0088	0.0125
75	0.0016	0.0026	0.0031	0.0032	0.0039	0.0058	0.0046
80	0.0003	0.0005	0.0007	0.0007	0.0008	0.0012	0.0023
85	0.0017	0.0027	0.0033	0.0034	0.0041	0.0061	0.0083
90	0.0003	0.0005	0.0006	0.0006	0.0007	0.0010	0.0011
91	0.0003	0.0005	0.0006	0.0006	0.0007	0.0010	0.0018
92	0.1843	0.2972	0.3595	0.3706	0.4505	0.6691	0.6991
93	0.0003	0.0005	0.0006	0.0006	0.0007	0.0010	0.0011
Sum households emissions	0	0	0	0	0	0.0090	0

Table A.23 Emissions to air of HFC-227ea for Norway 1996-1997 by detailed industry. Tonnes.

Industry code	1996	1997
Sum emissions from industry	0,0483	0,1064
01	0.0003	0.0024
02	0.0003	0.0012
05	0.0007	0.0018
10	0	0.0006
11	0.0003	0.0012
13	0	0.0006
14	0	0.0006
15	0.0024	0.0054
16	0	0.0006
17	0	0.0006
18	0	0.0006
19	0	0.0006
20	0	0.0024
21	0	0.0018
22	0	0.0018
23	0	0.0012
24	0.0003	0.0042
25	0	0.0006
26	0	0.0018
271	0.0003	0.0006
279	0.0003	0.0018
28	0.0010	0.0018
29	0.0302	0.0230
30	0	0.0006
31	0	0.0018
32	0.0003	0.0012
33	0	0.0012
34	0	0.0006
35	0	0.0030
36	0	0.0018
37	0	0.0012
40	0	0.0024
45	0	0.0030
50	0.0006	0.0036
55	0.0007	0.0012
601	0.0003	0.0006
602	0.0014	0.0024
603	0	0.0006
611	0	0.0018
619	0.0003	0.0006
62	0.0003	0.0006
63	0.0007	0.0018
64	0	0.0012
65	0	0.0042
70	0.0026	0.0066
75	0.0007	0
80	0.0003	0.0006
85	0.0017	0.0024
90	0.0003	0.0006
91	0.0003	0.0006
92	0.0014	0.0024
93	0.0003	0.0006
Households emission	0	0

Table A.24 Emissions to air of PFC-14 for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions from industry	313	242	254	230.5	208.5	187.4	200.8
279	313	242	254	230.5	208.5	187.4	200.8
Household emissions	0	0	0	0	0	0	0

Table A.25 Emissions to air of PFC-116 for Norway 1991-1997 by detailed industry. Tonnes.

Industry code	1991	1992	1993	1994	1995	1996	1997
Sum emissions from industries	14	11	11	10.5	8.9	5.6	7.7
279	14	11	11	10.5	8.9	5.6	7.7
Household emissions	0	0	0	0	0	0	0

Table A.26 Emissions to air of PFC-218 for Norway 1995-1997 by detailed industry. Tonnes.

Industry code	1995	1996	1997
Sum emissions from industry	0,0135	0,0412	0,0555
05	0.0008	0.0023	0.0036
11	0.0002	0.0006	0.0009
15	0.0012	0.0037	0.0057
28	0.0015	0.0047	0
29	0.0002	0.0005	0
50	0.0009	0.0029	0.0046
55	0.0009	0.0027	0.0041
602	0.0002	0.0006	0.0009
611	0	0	0
619	0.0002	0.0006	0.0009
63	0.0005	0.0017	0.0026
70	0.0002	0.0005	0.0007
75	0.0001	0.0002	0.0002
80	0	0	0.0001
85	0.0001	0.0002	0.0004
90	0	0	0
91	0	0	0.0001
92	0.0065	0.0200	0.0307
Household emissions	0	0	0

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