# PROGRESS REPORT ON THE REDUCTION OF THE INPUT OF NUTRIENTS TO THE NORTH SEA

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This national progress report follows the "Format for national progress reports on measures to reduce nutrient inputs into areas where these inputs are likely, directly or indirectly, to cause pollution", adopted by the Paris Commission during the eleventh meeting (Dublin 19-22 June, 1989). The bold printed headings in this report are taken from this format.

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# I Introduction

## The Second and Third North Sea Ministerial Conference

During the Second North Sea Ministerial Conference on the Protection of the North Sea it was agreed to achieve substantial reduction (about 50 %) in the input of phosphorus and nitrogen between 1985 and 1995 into areas where these inputs are likely, directly or indirectly, to cause pollution . This objective was confirmed by the Third North Sea Conference. The Third North Sea Conference also agreed that further measures are required in order to meet the aim of a reduction of the order of 50 % of the input of nutrients between 1985 and 1995 into areas where they are likely, directly or indirectly, to cause pollution. To this end the states concerned agreed to take the following measures or a combination of these measures:

(1) **municipal treatment plants:**
to apply nutrient removal at municipal sewage treatment plants ( e.g. with a capacity above 20.000 p.e.), reaching effluent concentrations of nitrogen below 10-15 mg/l and of phosphorus below 1-2 mg/l;

(2) **industry:**
to limit the nutrient content of relevant industrial effluents not entering municipal waste water treatment plants by applying Best Available Technology; and

(3) **agriculture:**
to aim at achieving an environmentally acceptable relationship between crop uptake and the amount of nutrient applied in manure and fertilizer and to that end:
- to establish regulations for the handling and application of manure and fertilizers, including the use of manure and fertilizer application plans or records;
- to ensure the availability of adequate manure storage or treatment capacity for the longest period during which the application of manure is restricted;
- to promote extensification measures, in particular alternative methods of arable farming and livestock management; and
- to take measures to prevent inputs of manure and fertilizers into water bodies.

Furthermore during the Third North Sea Ministerial Conference it was agreed to apply the precautionary principle and to co-ordinate initiatives to reduce nutrient inputs with the aim of achieving a 50% reduction in particular through implementation by the Contracting Parties to the Paris Convention of the programme for the reduction of nutrient inputs as established by the Paris Commission. (PARCOM RECOMMENDATION 89/4)

## Paris Commission

At its meeting in 1988, the Paris Commission adopted PARCOM Recommendation 88/2 on the reduction of nutrients. In this recommendation the commission endorsed the objectives agreed by the Second North Sea Conference. Contracting Parties agreed inter alia:

a. to take effective national steps to reduce nutrient input into areas where these inputs are likely, directly or indirectly, to cause pollution.

b. to aim to achieve a substantial reduction(of the order of 50%) in the input of phosphorus and nitrogen into these areas between 1985 and 1995, or earlier as possible.

Preceding the Third North Sea Conference the Paris Commission adopted PARCOM RECOMMENDATION 89/4 on a coordinated programme for the reduction of nutrients.
These measures are to be applied before the end of 1995 by states bordering the North Sea, Skagerrak and the Kattegat.
The Commission also adopted a reporting format for national progress reports . Reporting was required for those countries which have discharges into areas where such inputs are likely to cause pollution.

The Netherlands

The first national progress report on measures to reduce nutrient inputs into areas where these inputs are likely, directly or indirectly, to cause pollution was presented to the working group on Nutrients of the Paris Commission in 1989.
To show in what way the target is being implemented the Netherlands also presented the first report at the Third International Conference on the Protection of the North Sea. The first report contained estimated figures for 1985 and expected figures for 1990 and 1995 on nutrient loads to Dutch surface waters.

The present report on nutrients supplements the previous report and contains estimated figures for the situation in 1990.
This report enables a comparison of the 1985 and 1990 data and allows an assessment of the progress in the reduction of discharges from nutrients to the Dutch surface waters in the period 1985-1990.
Parts of this report were presented to the Working Group on Nutrients of the Paris Commission in 1991 and have as such been published in" Nutrients to the Convention Area" adopted at the Ministerial Meeting of the Oslo and Paris Commissions held in Paris on 21 and 22 September 1992.
This report will further be used to prepare an overview document for the Intermediate Ministerial Meeting on the Protection of the North Sea which is scheduled to be held by the end of 1993. At this meeting amongst other items the problems encountered with the implementation of the North Sea Conference Declaration with regard to nutrients will be discussed. To this meeting also the ministers of agriculture are invited to participate.

## II Measures taken or planned since 1985.

### 2.1 Municipal treatment plants.

**a) To what extent will the total of the treatment capacity for municipal waste water be increased between 1985 and 1995? (where appropriate indicate also which changes are expected for this period in the total production of municipal waste water)**

Population served

The population connected to the sewerage network has increased from 92% in 1985 to 97% in 1990. The part of the population served by sewage treatment works increased by 13% from 82% in 1985 to 95% in 1990. In 1995 it is expected that 98% of the population is served by sewage treatment works.
The part of the population that is served by more than primary treatment has increased with 20 % from 75% in 1985 to 95% in 1990. The treatment capacity will be at least secondary treatment in 1995. See table 1.

Capacities.

In 1985 the total waste water treatment capacity of a total of 504 sewage treatment works was 22,4 million population equivalents. This capacity increased to 23,8 million p.e. in 1989 for a total of 469 sewage treatment works and is expected to increase to 25 million p.e. in 1995. Compared to 1985 this means an increase of the total waste water treatment capacity in 1995 of 11%.

Capacities used.

The treatment capacity is not fully utilised. The % of the total treatment capacity used increased from 82% in 1985 to 88% in 1990.
In 1985 and 1990 respectively 17,7 million p.e. and 20,4 million p.e. was actually used.
In 1990 households used about 14,9 million p.e. and industry used about 5,6 million p.e.,which is respectively 79% and 21% of the total capacity used.
In 1995 21,3 million p.e. will actually be used. Compared to 1985 this would mean an increase of 20% of the treatment capacity actually used.
During the period 1985-1995 the total production of municipal waste water from households is expected to increase from 14,5 to 15,5 million p.e., which represents an increase of 7%. See table 1.

Table 1:
**Municipal sewage treatment for households in 1985 and 1990 and expected figures for 1995.**

| | 1985 | | 1990 | | 1995 | |
|---|---|---|---|---|---|---|
| | million p.e. | % of total | million p.e. | % of total | million p.e. | % of total |
| Population equivalents in the Netherlands | 14,5 | 100% | 14,9 | 100% | 15,5 | 100% |
| | | | | | | |
| **not connected to sewer** | 1,2 | 8% | 0,45 | 3% | 0,4 | 2,5% |
| discharging into surface water | 0,6 | 4% | 0,3 | 2% | 0,2 | 1,5% |
| discharging into soil | 0,6 | 4% | 0,15 | 1% | 0,2 | 1,0% |
| | | | | | | |
| **connected to sewer** | 13,3 | 92% | 14,5 | 97% | 14,9 | 98% |
| not treated | 1,4 | 10% | 0,3 | 2% | 0 | 0% |
| primary treatment | 1,1 | 8% | 0,1 | 0,6% | 0 | 0% |
| secondary treatment | 10,6 | 73% | 13,4 | 89% | 3 | 20% |
| tertiary treatment (P removal) | 0,3 | 2% | 0,9 | 6% | 11,9 | 75% * |

*) This treatment will largely also include a high N-removal efficiency

**b) To what extent will the total tertiary treatment capacity for nutrient removal from municipal waste water be increased between 1985 and 1995 ? (please specify separately for phosphorus removal and for nitrogen removal)**

Phosphorus

In 1985 only a small part of the sewage treatment works was equipped with a phosphorus-removal facility. Taken as a mean over all sewage treatment works the mean phosphorus removal efficiency was 41% in 1985. The phosphorus removal efficiency increased to 55% in 1990 and is expected to be 75% in 1995 as a result of measures taken.

General Administrative Order

In may 1991 the EEC adopted EC directive 91/271 " Council Directive concerning Urban Waste water" (OJ No L. 135/40: 30.5.91).
Article 5 paragraphs 2, 3 and 4 of the Urban Waste Water Directive will be applied throughout the Netherlands. The Urban Waste Water Directive will be implemented

nitrogen, phosporus and urban waste water will be incorporated.

The General Administrative Order on phosphorus removal from municipal sewage treatment works came into force on 1 July 1991.
In this General Administrative Order limit values are incorporated. (see table 2)
The application of the limit values per installation can be disposed if a phosphorus removal efficiency of at least 75% is reached.
This minimum figure of 75% is taken as a "regional mean" over each administrative area of the water authorities in charge of water quality management.

Nitrogen

Situation in 1990

Taken as a mean over all sewage treatment works the nitrogen removal efficiency was 46% in 1985 and increased to 50% in 1990. This is mainly due to a higher percentage of installations which show a relatively high nitrogen removal efficiency of 60-70%. The total capacity of these installations is about 6 million population equivalents. Moreover most sewage treatment works carry out substantial nitrification (ammonium-nitrogen removal) and some denitrification (nitrate-nitrogen removal).

General Administrative Order

The General Administrative Order on nitrogen removal from municipal sewage treatment works came into force on 1 september 1992.
In this General Administrative Order limit values are incorporated.(see table 2)
These limit values should be complied with at 1 January 1998 at the latest for existing installations.
Furthermore this regulation contains the objective to reach a nitrogen removal efficiency at the sewage treatment works of at least 75% by 1998.
This minimum figure of 75% is taken as a "regional mean" over each administrative area of the water authorities in charge of water quality management.

The policy objective is to reach 50% reduction of nitrogen discharges from municipal treatment works at 1995 compared to 1985, but at the latest at 1998.

**What discharge limits have been set since 1985 or will be set in the period from 1989-1995 and what is the time schedule for implementing these limits ?**

**Table 2:**
**Discharge limits for sewage treatment works for total Nitrogen and total Phosphorus in mg/l**

| P-total | discharge limit mg/l | time | applies to |
|---|---|---|---|
| | 2 | presently | new mstp 20.000-100.000 p.e. |
| | 1 | presently | new mstp > 100.000 p.e. |
| | 2 [1)] | by 1-1-95 | new and existing mstp < 20.000 p.e. |
| | 2 [1)] | by 1-1-95 | existing mstp 20.000-100.000 p.e. |
| | 1 [1)] | by 1-1-95 | existing mstp > 100.000 p.e. |
| **N-total** | **discharge limits mg/l** | **time** | **applies to** |
| | 10/15 [2)] | by 1-9-92 | new mstp ≥ 20.000 p.e. |
| | 15 | by 1-9-92 | new mstp < 20.000 p.e. |
| | 15 [1)] | by 1-1-98 | existing mstp < 20.000 p.e. |
| | 10 [1)] | by1-1-98 | existing mstp ≥ 20.000 p.e. |

1) depending on 75% removal efficiency.
2) The discharge limit of 15 mg/l applies till 1-1-95 for new mstp's, if there is simultaneous phosphate removal. After this date also for these installations a discharge limit of 10 mg/l will apply.

## 2.2 Detergents

**a) What was the usage of phosphate-free detergents in 1985 ?**

Of the 165.000 tonnes of detergents used in 1987 20.000 tonnes were phosphate free. (12%) The remaining 145.000 tonnes of detergents containing phosphate represent a total phosphorus quantity of 8.000 tonnes. Compared to 1980, when virtually no P-free detergents were used, the total quantity of phosphate in detergents was 10.000 tonnes.

**b) What measures have been taken since 1985 or will be taken in the period from 1990-1995 to increase the use of phosphate-free detergents ?**

The Government and the Netherlands Association of Soap Manufacturers signed an agreement in 1987 comprising the following main items:

- the sale of phosphate-free detergents will be encouraged;
- the total amount of phosphate in detergents will be reduced from 10000 tonnes in 1980 to 5.000 tonnes in 1988;
- after 1988 the total amount of phosphate in detergents will be further reduced, so that no phosphate will be used in detergents in the Netherlands after 1990.

In 1990 it was concluded that 100 % of the used detergents were phosphate-free

For dishwashers both phosphate-free detergents and phosphate- containing detergents are available on the market.
These detergents were not part of the agreement and represent a total quantity of 500 tonnnes of phosphate. Phosphate free alternatives represent currently 25% of the total market.

## 2.3 Agriculture

**a) What measures have been taken since 1985 or will be taken in the period from 1989-1995 with respect to the spreading of manure or chemical fertilisers ? (for instance, restrictions on allowable amounts or on the time of spreading, or measures to reduce atmospheric emissions of ammonia)**

Legislation

Under the Soil Protection Act and the Fertilizer and Manure Act a comprehensive set of legal measures was developed . The use and spreading of manure is regulated by the Soil Protection Act and the Fertilizer and Manure Act regulates mainly the production, distribution and registration of manure and lays down the regulations for manure accounting.

Soil Protection Act

The Manure Decree under the Soil Protection Act defines limits for the amount of manure permitted to be spread and specifies conditions for the method and time of spreading. The limits for permitted amounts of manure are based on phosphorus, expressed in kilogramme per hectare. The final objective of the regulation is to strike a balance between the amount of phosphorus used and the uptake of the crop. This objective should be reached by the year 2000. This final goal will be reached in stages so the agricultural industry can develop methods to reduce the manure surpluses at that time.

The phosphorus limits for manure spreading apply to all farmland in the Netherlands, but a distinction was drawn between three land-use categories to which different limits apply: grassland, maize and arable land. The use of manure will be reduced in stages in conformity with the Decree on the use of manure (see table 3). The final limits for the year 2000 still have to be formulated in relation to the actual crop uptake at that time. The limits mentioned in table 3 are considered as a general protection level for the soil. Higher protection levels, resulting in lower manure limits, than those generally found may be established under the Soil Protection Act by provincial authorities for areas where the soil needs additional protection, such as groundwater protection zones. When the Decree on the use of other organic fertilisers comes into force, the manure limits will apply to manure and other organic fertilisers such as compost and sewage sludge. From 1995 onwards the use of artificial phosphate fertiliser will be included in the maximum fertiliser limits (see table 3).

**table 3.**

**Regulations governing the limits of the total quantity of phosphorus on farmland in conformity with the Manure Decree under the Soil Protection Act.**

| stage | including | grassland | maize land | other tillage |
|---|---|---|---|---|
| I: 1987 | manure from cattle, pigs and poultry | 250 kg $P_2O_5$/yr | 350 kg $P_2O_5$/yr | 125 kg $P_2O_5$/yr or 250 kg $P_2O_5$/2 yr |
| II: 1991 | manure from cattle, pigs and poultry | 200 kg $P_2O_5$/yr | 250 kg $P_2O_5$/yr | 125 kg $P_2O_5$/yr |
| II: 1992 | all manure | | | |
| II: 1993 | all manure and organic fertilizer | | 200 kg $P_2O_5$/yr | |
| II: 1994 | all manure and organic fertilizer | | 150 kg $P_2O_5$/yr | |
| III: 1995 | all manure, organic and phosphorus fertilizer | 175 kg $P_2O_5$/yr | 125 kg $P_2O_5$/yr | |
| IV: 2000 | all manure, organic and phosphorus fertilizer | 110 kg $P_2O_5$/yr (provisional) | 70 kg $P_2O_5$/yr (provisional) | 70 kg $P_2O_5$/yr (provisional) |

In groundwater protection areas the final limits for 2000 are already implemented.

The Manure Decree also contains regulations governing the time and method of using manure in order to prevent run-off and leaching at times when the soil is not covered by crops (see table 4 and 5). These measures should also reduce the ammonia emissions into the air during and after manure spreading.

table 4

**Regulations governing the method of manure and fertiliser application in conformity with the Manure Decree under the Soil Protection Act.**

| stage | including | grassland | maize land | other tillage |
|---|---|---|---|---|
| I: 1987 | manure from cattle, pigs and poultry | - | underworking within 48 hours after spreading | |
| II: 1991 | manure from cattle, pigs and poultry | - | immediate underworking or low ammonia emission spreading methods | |
| II: 1992 | all manure | low ammonia emission spreading methods from 1/2 until 15/6 on sandy soil area (1) | | |
| II: 1994 | all manure and organic fertilizer | low ammonia emission spreading methods from 1/2 until 15/6 on whole area (1) | | |
| III: 1995 | all manure and organic fertilizer | low ammonia emission spreading methods in spreading period on whole area (1) | | |

(1) : Spreading of manure is prohibited from 1/10 until 1/2 (see table 5).

**table 5**

**Regulations governing the period when manure and fertiliser application is prohibited in conformity with the Manure Decree under the Soil Protection Act.**

| stage | including | grassland | maize land | other tillage |
|---|---|---|---|---|
| I: 1987 | manure from cattle, pigs and poultry | - | on sandy soil area : from harvest until 1/11 when not cultivated, from 1/10 until 1/11 when cultivated | |
| I : 1990 | manure from cattle, pigs and poultry | from 1/10 until 1/12 and when snow covered from 1/1 until 15/2 | | |
| II: 1991 | manure from cattle, pigs and poultry | from 1/10 until 1/1 on whole area | from 1/9 until 1/1 on sandy soil, cleared peat land and loess area (2) | |
| II: 1992 | all manure and organic fertilizer | from 1/10 until 1/1 on whole area and from 1/1 until 1/2 on sandy soil, cleared peat land and loess area (1) | | |
| II: 1993 | all manure and organic fertilizer | | from 1/9 until 1/2 on sandy soil, cleared peat land and loess area (2) | |
| II: 1994 | all manure and organic fertilizer | from 1/10 until 1/2 on whole area (2) | | |
| III: 1995 | all manure and organic fertilizer | | | |

(1) :Low ammonia emission spreading methods from 1/2 until 15/6 (see table 2).
(2) :Immediate underworking or low ammonia emission spreading methods in whole spreading period (see table 2).

**b) What measures have been taken since 1985 or will be taken in the period from 1989-1995 with respect to "farm management" ?(for instance, restrictions on the number of livestock, establishment of mandatory manure or fertiliser plans or requirements for manure storage facilities)**

Fertilizer and Manure Act

In conjunction with the regulations for manure under the Soil Protection Act, the Fertilizer and Manure Act provides a set of regulations mainly concerning an appropriate accounting system and the distribution of manure. The Fertilizer and Manure Act also contains a system of charges. Elements of the regulation are mentioned briefly below:

1. manure accounting, obligatory for farmers producing more than 125 kilogramme $P_2O_5$ per hectare;
2. payment of surplus charges when producing more than 125 kilogramme $P_2O_5$ per hectare;
3. foundation of a National Manure Bank.

The Fertilizer and Manure Act lays down further conditions, mainly in order to stop the rising trend of manure production:

1. the amount of manure produced and registered at 31 December 1986 is taken as a reference value, if this reference value is above 125 kilogramme $P_2O_5$ per hectare, the expansion of farms causing a manure production above the reference value is not allowed, the establishment of new farms is only allowed when the manure production does not exceed 125 kilogramme $P_2O_5$ per hectare;
2. the allocation of manure production rights from one farm to another is prohibited;
3. the exchange of manure types, theoretically resulting in a lower manure surplus, is prohibited.

The amount of manure surplus is determined at farm level by production data and the area available for spreading which are reported to the authorities.

Minerals accounting has been introduced for individual undertakings from 1989 onwards and will serve in the first instance as an aid in running the undertaking, as well as being used for information purposes. The aim is to halt mineral losses in individual undertakings. Minerals accounting means that a check is kept by undertakings on how many minerals enter and how many minerals leave the undertaking in the form of products. The difference between them is a measure of the mineral losses to the environment. The possibility of regulating mineral emissions on the basis of minerals accounting will also be looked into. If in the next few years, minerals accounting proves to be a suitable regulatory instrument, it will be introduced from 1994 onwards in relation to or coordinated with the existing manure accounting system.
In January 1990, the Minerals Input Registration System (MIRS) is introduced into the pig and poultry farming industry. The objective is a more efficient use of minerals in fodder in order to reduce the manure and mineral surpluses by means of a financial

incentive. Expanding the application of MIRS is under consideration.

**c) What other measures have been taken since 1985 or will be taken in the period from 1989-1995 to reduce the contribution from agriculture to the load of nutrients? (for instance, treatment of manure)**

The manure surpluses will not only be reduced by means of statutory regulations, but also by practical measures with respect to the fodder, manure distribution and manure processing. Measures to reduce the nutrient content of fodder, removing obstacles for the manure distribution and increasing the storage capacity to tide over the period when manure application is prohibited are the main points of the short term approach. Manure processing is the main point of the medium long and long term approach.

The Government together with the agricultural sector will give shape to several multi-year agreements in the field of research, public information and educational activities for achieving integrated cultivation systems, integrated nitrogen management and other process integrated systems. The following initiatives will also be taken.

Manure distribution

1. The approach to remove obstacles for the manure distribution is specified in the documents "Potential distribution of manure" and "Strategy for manure distribution". Improving the quality of manure, improving the infra-structural facilities and increasing the acceptance of manure in receiving regions are the main points of the manure distribution policy.
2. Consultations with the target group on introducing quality certificates to promote acceptance of manure in arable farming.

Fodder

1. An Action Programme has been established to reduce the manure surpluses (in fact minerals surpluses) by measures with respect to the fodder. For several elements (phosphorus, nitrogen, copper, zinc and cadmium) it is pointed out how policy tools as research, public information and legislation have been brought into action for the short term (1986-1988) or will be brought into action for the medium long term (1988-1992) period. This Action Programme will be up-dated this year.
2. Discussions with the feed industry are conducted to reach agreement on reductions in phosphorus, nitrogen and heavy metals in fodder.

Manure processing

1. The approach with respect to manure processing is specified in the document "Strategy for manure processing". In 1985, research was started to develop large scale manure processing and in 1988 a fund for pilot projects on manure process-

ing was established. In June 1988, the Government installed a commission to survey obstacles for the realisation of large scale manure processing and advise on methods to tackle these obstacles. The commission reported in March 1989. On the basis of this report the Government set a target for realisation of a processing capacity of 6 million tonnes manure by the agricultural sector before 1995. With a view to this task, research on the potential market for manure processing products has been conducted and information activities for the license application procedure have been carried out. The EC has approved the Dutch subsidy programme of up-scaling manure processing industry. The agricultural organisations are working on the organisational and financial conditions to bring a fast realisation of large scale manure processing within reach.

2. The objective is a capacity of 6 million tonnes or the equivalent of 25 million kg $P_2O_5$ in 1994. The municipal and provincial authorities play an important role here, e.g. in finding suitable locations. If this target will not be reached in time by the agricultural sector, measures affecting the live-stock volume will be taken.

Research

1. Research is being conducted in conjunction with feed industry to develope fodder with a low phosphorus and nitrogen content (see also point c.), the take-up of fodder and the use of additives, the possibilities of environmentally-friendly agrification, the development and application of environmentally-friendly (bio-)technologies, the development of mineral balances at undertaking, national and international level in which input and output are in equilibrium as far as possible.
2. Pilot undertakings will be set up or undertakings adapted to develop and test the elements referred to above in situ.

Public information

1. The devising of public information programmes is being encouraged both financially and in terms of content and these are aiming at informing individual farmers about practical ways of using more environmentally-friendly production techniques.

## 2.4 Fish farming

**a) What measures have been taken since 1985 or will be taken in the period 1989-1995 to reduce the contribution from fish farming to the load of nutrients ?**

Fish farming is a relatively small sector in the Netherlands. The contribution from this source to the nutrients load is considered to be of minor importance.
There are about 80 fishfarms in the Netherlands, mainly with recirculation systems. Discharge of effluents into surface waters is already licensed and in general forbidden. Only limited quantities of sludge from fishfarms may be spread on agricultural land.

## 2.5 Industry

**a) Which industrial sectors are discharging significant amounts of phosphorus and nitrogen ?**

Direct industrial discharges into Dutch surface waters were estimated for 1985 and 1990. The industrial discharges to the sewerage network have not been estimated separately. These indirect discharges have been covered in chapter 1.
The main industrial sector for phosphorus is the fertiliser industry which discharged 12 thousand tonnes in 1985. These discharges have been reduced by 16 % to 9,9 tonnes in 1990. The inorganic chemical industry and the potato starch industry are of minor importance. The main industrial sectors discharging nitrogen are the organic chemical industry, the potato starch, the fertilizer industry, and the iron and steel industry, See table 6 and 7.

**b) Which measures have been taken since 1985 or will be taken in the period 1989-1995 to reduce these discharges ?**

Table 6 and 7 below give an overview of the estimated direct industrial discharges into Dutch surface waters in 1985 and 1990 as well as the expected discharges in 1995. The estimates for 1985 and 1990 are based upon measurements of phosphorus and nitrogen in effluent. The prognosis of expected discharges in 1995 was drawn up reviewing existing licences and screening the technologies used, the measures already taken in the period 1985-1990 and the planned measures in the period 1990-1995. The most important plants, discharging relatively large quantities of nitrogen and/or phosphorus have been reviewed.

For most industrial sectors a substantial reduction is expected over the period 1985-1995. See table 6 and 7. In the phosphate-fertilizer industry measures will be taken to reduce phosphate emissions in accordance with Best Available Technology. This includes measures to improve choice of feedstock and production process. The possibility of reuse of phosphogypsum is under study.
The reduction of the nitrogen emissions from the organic chemical industrial sector is relatively limited. This is due to the situation at one company, where a substantial reduction was achieved some years before 1985. This company complies with what is considered as best available technology for nitrogen removal. This includes nitrification/denitrification treatment.
In the potato starch industry measures are taken in 1991 to reduce nitrogen and phosphorus emissions by protein recovery followed by oxidative and anoxidative biological waste water treatment. These measures have resulted in a 98% reduction of nitrogen and phosphorus emissions from this sector.
In the nitrogen- fertilizer industry and the iron and steel industry measures that are or will be taken exist of reduction of ammonium emissions by steamstripping and/or scrubbing followed by reuse of the ammonia. These measures have already resulted in substantial reductions of nitrogen emissions from these sectors.

**table 6.**

**Direct industrial discharges from Phosphorus**

| Phosphorus | 1985 (kton) | 1990 (kton) | 1995 (kton) |
|---|---|---|---|
| potato starch industry | 0,3 | 0,3* | 0,02 |
| fertilizer industry | 11,8 | 9,9 | 5,9 |
| inorganic chemical industry | 0,4 | 0,3 | 0,2 |
| organic chemical industry | 0,1 | 0,1 | 0,1 |
| iron and steel industry | 0.01 | 0,01 | 0,01 |
| others | 1 | 1 | 0,5 |
| total | 13,5 | 11,6 | 6,8 |

* In 1991 a discharge of 0,02 was achieved.

**table 7.**

**Direct industrial discharges from nitrogen**

| Nitrogen | 1985 (kton) | 1990 (kton) | 1995 (kton) |
|---|---|---|---|
| potato starch industry | 3 | 3 | 0,06 |
| fertilizer industry | 3,1 | 1,9 | 1,4 |
| inorganic chemical industry | 0,1 | 0,1 | 0.05 |
| organic chemical industry 1) | 3,8 | 1,7 | 2,8 |
| iron and steel industry | 2 | 1,5 | 1,5 |
| others | 4 | 4 | 2,7 |
| total | 16 | 12,2 | 8,5 |

1) one company(discharging 1.750 tonnes in 1985) installed advanced treatment and complies with Best Available Technology requirements. The expected value for 1995 is not yet adjusted.

## 2.6 Atmospheric emissions.

### a) Which are the main sources of atmospheric emissions of phosphorus and nitrogen?

The atmospheric emission of phosphorus is insignificant and does not contribute to the total load to surface water.

The sources of atmospheric emissions of nitrogen are to be divided into $NO_x$ sources and ammonia ($NH_3$) sources. The main $NO_x$ sources are traffic, electricity production and industry. The estimated emissions in 1985 and 1989, and the expected emissions in 1995 are presented in table 8.

**Table 8.**
**Atmospheric emissions of $NO_x$ in 1985 and 1989 and expected emissions in 1995 (1000 tonnes N-$NO_2$ per year)**

| source | 1985 | 1989 | 1995 |
|---|---|---|---|
| traffic | 330 | 346 | 269 |
| electricity production | 82 | 76 | 55 |
| industry including refeneries | 83 | 85 | 57 |
| households\others | 49 | 45 | 41 |
| total | 544 | 552 | 422 |

The main ammonia source is agriculture. Agriculture accounts for 94% of the total atmospheric emissions of ammonia. Table 9 gives estimated quantities emitted in 1985 and 1989.

**Table 9.**
**Atmospheric emissions of $NH_3$ in 1985 and 1989 and expected emissions in 1995 (1000 tonnes per year)**

| source | 1985 | 1989 | 1995 |
|---|---|---|---|
| agriculture | 238 | 227 | 164 |
| industry | 6 | 7 | 4 |
| households | 9 | 10 | 9 |
| total | 253 | 244 | 177 |

**b) Which measures have been taken since 1985 or will be taken in the period from 1988-1995 to reduce these emissions ?**

1. Nitrogen oxides

Emissions of $NO_x$ in the Netherlands have shown a rising trend during the last few decades, even though a number of measures to reduce emissions have been taken. A number of recent measures, like the application of low $NO_x$ burners in electricity generation and industry and the introduction of three-way catalysts for motorcars, should change this rising trend into a falling one.

A General Administrative Order under the Air Pollution Act is now in force which specifies emission standards for large combustion installations, and a similar General Administrative Order under the Nuisance Act is in force for smaller installations. The values of these emission standards are given in table 10.

In addition, emission standards for $NO_x$ emissions from nitric acid plants are now in force. The authorities issuing permits are required to adhere to these emission standards as an upper limit and in a number of cases a lower limit is also defined in order to curb excessive economic disadvantages.

Table 10.

**$NO_x$ emission standards for industrial combustion installations ($mg/m^3$)**

| Source category | Decree on emission standards for combustion installations APA[1] | New standard [1] | |
|---|---|---|---|
| | | 1992 | 1994 |
| - new installations | | | |
| gas>20MW | 200 | 100 | 60 |
| gas<20MW | 200 | 100 | 60 |
| oil>20MW | 300 | 150 | 110 |
| oil<20MW | 300 | 150 | 110 |
| coal>50MW | 500 | 200 | 100 |
| upstream gas turbines on process furnaces | 200 g/GJ[2] | 30 g/GJ | |
| other gas turbines | 135 g/GJ[2] | 65 g/Gj | |
| gas motors | 270 g/GJ[2] | 190 g/GJ[3] | |
| -existing installations | | | |
| gas>20MW | 500 | 150[4] | |
| gas<20MW | 500 | 150[4] | |
| oil>20MW | 700 | 400/200 [4,5] | |
| oil<20MW | 700 | 400/200 [4,5] | |
| coal>20MW | - | 650 [4] | |
| gas turbines [6] | 135 g/GJ[2] | 65 g/GJ[8] | |

1 in $mg/m^3$ unless otherwise noted.
2 beginninig in 1990.
3 in 1993.
4 when burners are replaced but not later than 1998.
5 400 $mg/m^3$ for heavy fuel oil; 200 $mg/m^3$ for household oil I and II
6 dependent on remaining life.
7 greater than 300 MW 1000 $mg/m^3$ ( 1100 $mg/m^3$ for pulverized coal): smaller than 300 MW only the permit requirement applies.
8 in 1992

For cars Dutch emission standards are in accordance with the relevant EEC directives. The introduction of clean cars on a voluntary basis has been promoted by fiscal benefits which are available for cars that comply with the strict US standards by use of a regulated three-way catalyst. Emission standards for motorbikes are in line with EEC regulations.

To reduce atmospheric emissions further measures will be taken in the near future, leading to a reduction of total $NO_x$ emissions from 544 kilotons in 1985 to 422 kilotons in 1995. A further reduction to a total emission of about 323 kilotons will probably be achieved by the year 2000, mainly by a further reduction in the traffic sector.

The measures necessary to reach these goals have been published in the Governmental National Acidification Abatement Plan. A number of measures will not have a strict legal status, but will be implemented by agreements between the Government and industry or by fiscal measures.

The objectives for the emission of $NO_x$ have been presented in this plan: reductions of 20%, 50% and 75%, all in relation to 1980 emissions, should be achieved by 1994, 2000 and 2010 respectively. The reduction measures presented in the plan can be summed up as follows:

**$NO_x$ reduction measures**

**A. Stationary sources:**

1. energy conservation;
2. increase of total co-generation capacity;
3. houses: stricter isolating value compulsory by 1990;
4. power plants: stricter emission standards: approx. 200 mg $NO_x/m^3$;
5. industrial boilers: stricter emission standards;
6. central heating: low $NO_x$ boilers compulsory by 1991.

B. Mobile sources:

1. cars: fiscal measures to stimulate compliance with US standards;
2. cars: EC standards at US level in 1993;
3. lorries: subsidising programme, in advance of EC standards;
4. measures to discourage use of private cars;
5. improvement of public transport.

## 2. Ammonia

The Government published the overall goals for reducing the problem of acidification in the National Acidification Abatement Plan. As far as the ammonia emissions from agriculture are concerned the reduction percentages to be achieved are 30% and 50-70% by 1994 and 2000 respectively compared to 1980. Measures to achieve these reductions have been published in the Programme for Ammonia Reduction from Agriculture. The reduction measures presented in this Programme can be summed up as follows:

**Ammonia reduction measures**

1. minerals accounting for each individual farm;
2. fodder with low nitrogen content;
3. emission requirements for stalls (1994);
4. covering of manure storage built after 1 June 1987 compulsory by 1991;
5. manure spreading: immediate working under compulsory by 1991;

To reduce the emissions of ammonia a number of measures have already been taken, mainly in the agricultural sector. Firstly covering manure tanks is compulsory by 1991. Secondly immediate working under of manure is compulsary by 1991. Thirdly, emission limits are set to the period and quantity of manure application. See also chapter 3. Other measures are the promotion (on a voluntary bases at present) of stables with lower emissions of ammonia, fodder with a low nitrogen content and the introduction of compost filters.

III Expected results of the measures taken or planned.

**What will be the expected result of the measures described under 1-6 above on the input of nutrients to the North Sea in 1995 compared to the input in 1985 ?**

A. Calculation of effects of measures on inputs to the North Sea.

From a technical and statistical point of view estimation of the effect of the measures taken and planned on the inputs of nutrients to the North Sea is highly complicated so an accurate estimate cannot be made. Therefore in the previous "progress report on nutrients", presented at the Third Ministerial Conference on the Protection of the North Sea, effects of reduction measures on the load of nutrients to the dutch surface waters were estimated.
In this report the same method for estimating loads to surface waters has been used. These estimates are presented in table 11 and table 12 below.

**Table 11:**
**Load of nutrients to Dutch surface waters**

| SOURCE | 1985(ktonnes) | | 1990(ktonnes) | | 1995(ktonnes) 2) | |
|---|---|---|---|---|---|---|
| | $PO_4$-P | $N_{total}$ | $PO_4$-P | $N_{total}$ | $PO_4$-P | $N_{total}$ |
| industry direct discharges | 13,5 | 16 | 11,6 | 12,2 | 6,8 | 8,5 |
| waste water works | 10,8 | 38 | 6,2 | 40 | 3,5 | 30 |
| households not treated | 2,3 | 8 | 0,5 | 3 | 0,2 | 1,5 |
| agriculture 1) 2) 3) | 6,4 | 180 | 6,7 | 183 | 6,4 | 139 |
| deposition | - | 24 | - | 21 | - | 15,5 |
| total | 33 | 266 | 25 | 259 | 16,9 | 193 |

1) retarded effect due to slow desorption from the soil.
2) expected effects for 1990 and 1995 are based on model extrapolations and do not include all the measures which are under consideration at present.
3) provisional figures

**table 12:**

**Estimated reduction percentages for the nutrient load to dutch surface waters in the period 1985-1990 and expected reduction percentages in the period 1985-1995.**

| SOURCE | 1985-1989 (%) | | 1985-1995 (%) | |
|---|---|---|---|---|
| | $PO_4$-P | $N_{total}$ | $PO_4$-P | $N_{total}$ |
| waste water works | 40 | 0 | 70 | 20 1) |
| industry | 15 | 25 | 50 | 50 |
| untreated waste water | 85 | 65 | 90 | 80 |
| agriculture 2) | -5 | 0 | 0 | 20 |
| deposition | - | 15 | - | 35 |
| total | 25 | 5 | 50 | 30 |

1) 50% reduction expected before 1-1- 1998.
2) low reduction is due to retarded effects In 1990 the total amounts for both nitrogen and phosphorus (manure and fertilizer) applied in agriculture to fields has been reduced.

B. Discharges per nutrient emitting sector and some explanatory remarks.

1. Municipal waste water treatment

In the period 1985-1990 an increase of 20% of the treatment capacity actually used will be realised.
During this period 1985-1995 the total production of municipal waste water from households is expected to increase with 7%. These developments resulted in a reduction of discharges of phosphorus and nitrogen in untreated waste water of respectively 85 and 65 % in the period 1985-1990. Due to strict regulation of discharge limits for total nitrogen and phosphorus in effluent of sewage treatment works a reduction of 70% for phosphorus discharges is expected in 1995. For nitrogen a 50 % reduction is expected. Due to the physical attainability the reduction objective of the nitrogen load can only be realised immediately after 1995, but before 1998. However this delay of two years will have only a minor effect on the total nitrogen reduction, because municipal waste water accounts only for 14% of the total nitrogen load to the surface waters. (figure 4)

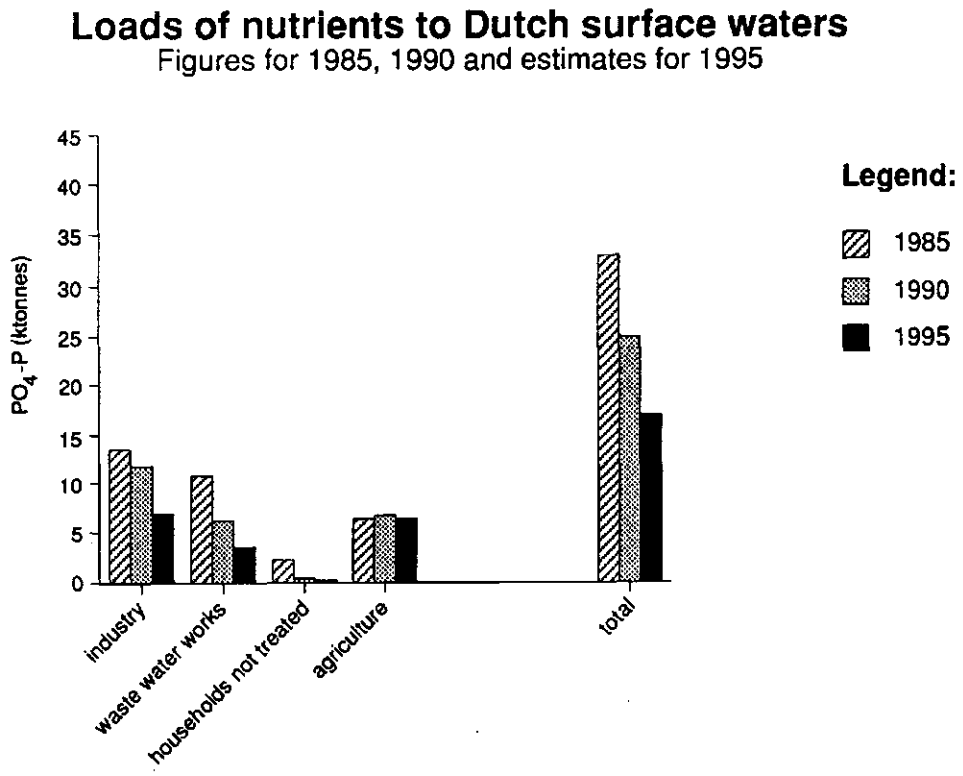


*Figure 1: Phosphate loads to Dutch surface waters*

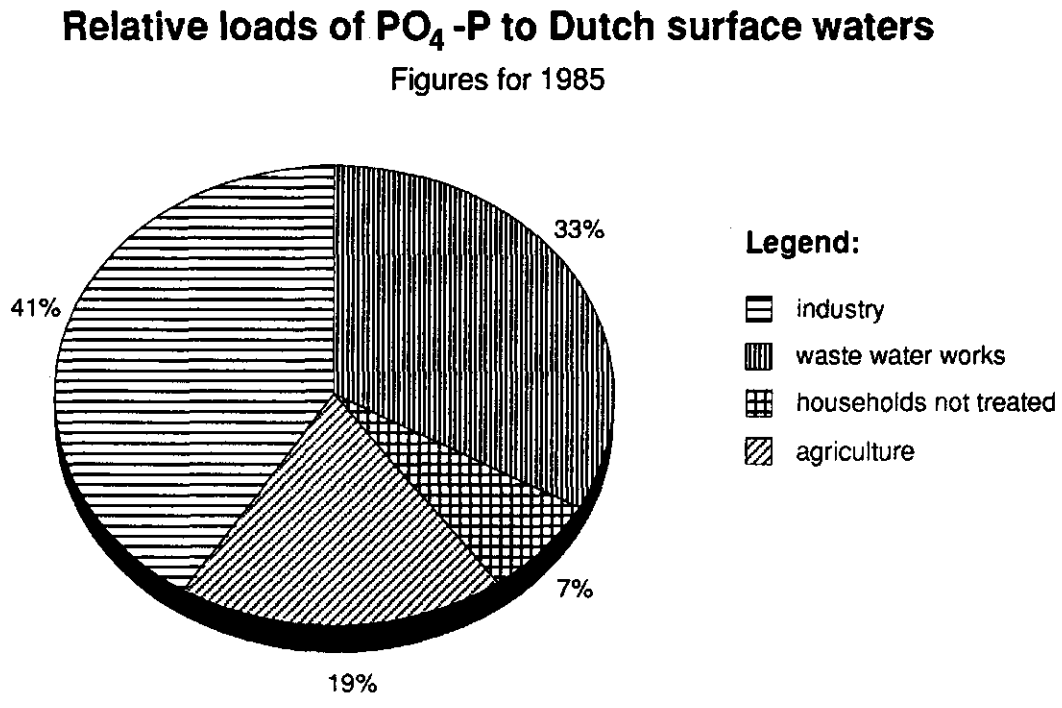


*Figure 2: Relative loads of $PO_4$-P to Dutch surface waters*

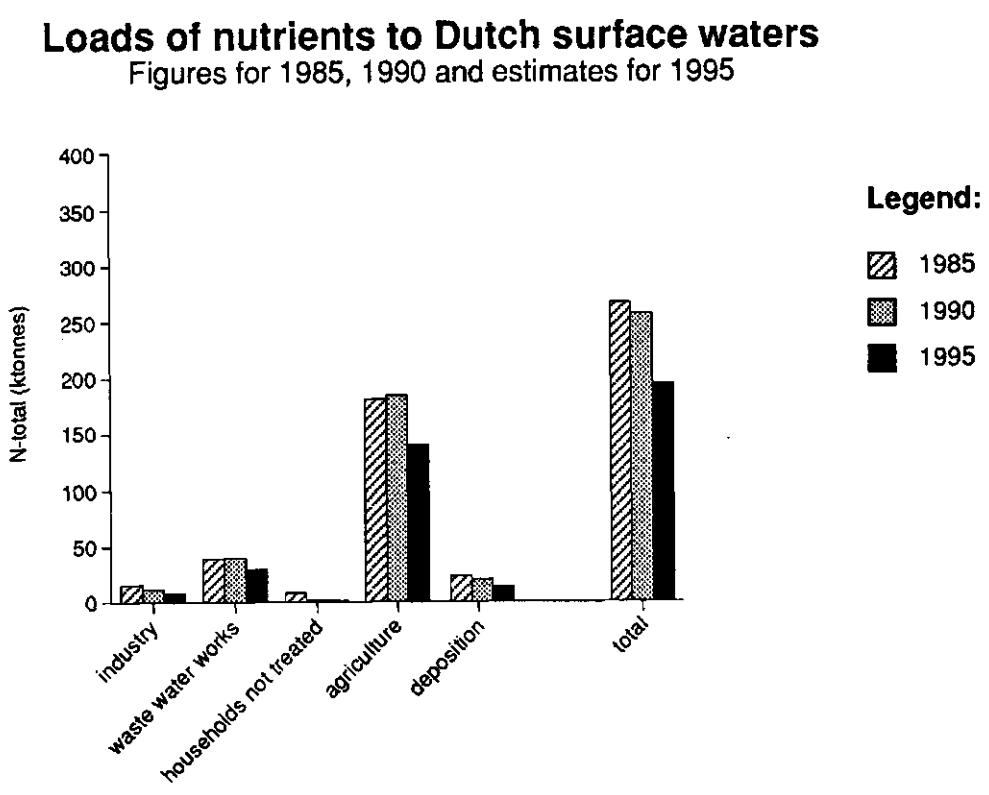


*Figure 3: Nitrogen loads to Dutch surface waters*

2. Detergents

Phosphorus-free textile detergents account for 100 % of the total market.

3. Agriculture

a) Phosphate

In the period 1985-1990 an increase of 5% of the discharges of phosphate from agriculture was estimated. However in the same period a reduction of 10 % was reached on the amount of phosphate applied to fields in agriculture as a result of the manure policy.
The retarded effect of measures taken on the actual discharges to the surface water is caused by slow desorption from the soil and slow groundwaterflow.
The amount of phosphate applied in agriculture is expected to reduce further in the period 1990-1995.

b) Nitrogen

Also for nitrogen a retarded effect of measures taken on the discharges to the surface water occurs.
In the period 1985-1990 a reduction of 9% of nitrogen application was reached as a result of measures taken. This reduction in application resulted only in a stabilization of the nitrogen discharges in the same period.

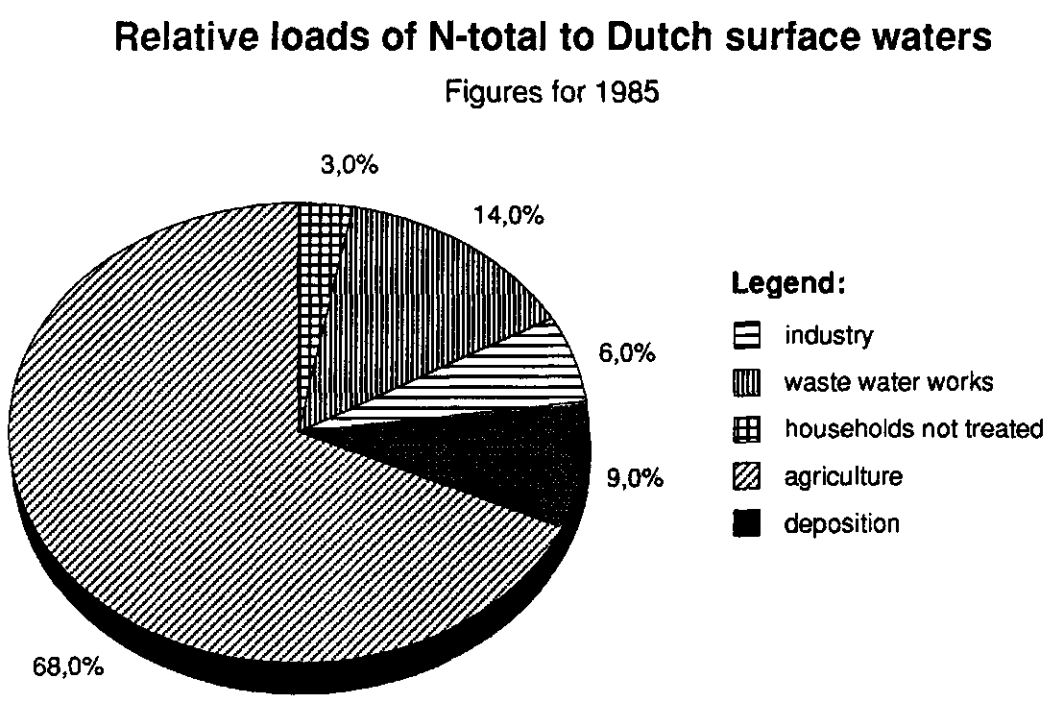


*Figure 4: Relative loads of N-total to Dutch surface waters*

In the period 1985-1995 a 20% reduction of nitrogen discharges to the surface water is expected.

possible additional measures

In addition to the measures already taken the following measures are under consideration as possible additional measures.

- Phosphate per hectare. Speeding up of the reduction of the amount of phosphorus allowed per hectare. Balance between use of phosphorus and crop uptake, 110/70/70 kg Phosphorus for respectively grassland, maize land and other tillage . Due to limitation of application of manure also the amount of nitrogen will be limited.
- Reduced nitrogen content in excretion by reduction nitrogen in fodder
- use of fertilizers and manure according to current advice programmes
- adjustment of advice programmes
- prevention of bringing nutrients directly into the watercourse by the use of specialized equipment.
- further restriction timing of non-application and the further use of improved application techniques to reduce ammonia votalization
- winter crop cover
- closed systems in greenhouse farming

The mineral balance

As already shown most additional measures will have an indirect, mostly retarded effect on the discharges of nitrogen and phosphorus to the surface water. For evaluation purposes of the reduction policy it is therefore proposed to use the mineral balance as an instrument to show the effectiveness of additional measures. The balance surplus gives an estimate of the overall mineral efficiency of the agricultural sector. In the Netherlands such balances have been composed during a number of years, based upon the regular national agricultural statistics.
The principles of calculation, and the calculations have been developed by the Central Bureau of Statistics (CBS) and are presented in the publication " Mineralen in de landbouw 1970-1990" with a summary in English.[1]

During 1986 the mineral surplus amounted to 822 ktonnes nitrogen per year and 97 ktonnes of phosphorus. Due to measures taken the surplus decreased in 1990 compared to 1986 with about 19% for phosphorus and about 17% for nitrogen. With this reduction the surplus of phosphorus returned to the level of the early seventies. The effect of the possible additional measures on the nitrogen surplus compared to 1986 is shown in table 13. If the measures to reduce the nitrogen surplus were implemented than the effect on the emissions to surface waters would still occur with a certain delay.

**table 13:**
**Reduction of the nitrogen surplus on the balance compared to 1986, if all possible additional measures under consideration were fully implemented**

| measure | total | % |
|---|---|---|
| Phosphate per hectare | 112 | 14 |
| reduction nitrogen in fodder | 40 | 5 |
| use according current advice programmes | 41 | 5 |
| adjustment of advice programmes | 36 | 4 |
| prevention of direct emissions | 10 | 12 |
| further restriction of non application and further use of improved application techniques | 88 | 11 |
| closed systems in greenhouses | 4 | <0.5 |
| winter crop cover | 3 | <0.5 |
| total reduction | 334 | 40 |

a) all values are indicative

[1] Mineralen in de Landbouw SDU publishers, The Hague, no C-67/1970-1990 : isbn 9035713915, 1992

The current policy will lead to a reduction of 20% of the nitrogen surplus in 1995 and about 25% in 2000. Implementation of the additional possible measures now under consideration would lead to a 40% reduction of the nitrogen surplus in 1995. Preliminary calculations showed that in 2000 this would lead to a 40% reduction of the discharges of nitrogen to the Dutch surface waters and this reduction and as a result of the same set of measures this reduction would furter continue after 2000.

4. Fish-farming

The relatively small fish-farming industry in the Netherlands is considered less relevant for national measures to reduce nutrient inputs.

5. Industry

A reduction of 50 % for nitrogen and of 50% for phosphorus is expected for discharges to surface waters by the industry in the period 1985-1995.
A 50 % reduction of discharges of phosphorus by the main emitting sector, the fertilizer industry, is expected within this period. In 1992 discharges of nitrogen and phosphorus from the potato starch industry have been reduced by 98% compared to 1985. Presently the policy objective of 50% reduction of nitrogen discharges from the industry has almost been reached, mainly due to the substantial reduction of nitrogen emissions in the potato starch industry.

6. Atmospheric emissions

The emission of $NO_x$ in the period 1985-1990 is about constant. Introduction of cleaner technology for motorcars and large combustion installations was compensated by a growth of the number of motorcars and apparatus. A reduction of 20% is expected in the period of 1985-1995 as a result of measures in traffic and electricity production sectors.
The reduction of ammonia emissions in the period 1985-1990 is about 10 %.
A reduction of 45% is expected in the period of 1985-1995 as a result of various measures in the agricultural sector.

## IV Conclusions

In the period 1985-1990 a 25% reduction of phosphorus discharges to surface water was estimated mainly due to the introduction of phosphate-free textile detergents and the clean up of industrial phosphorus discharges. Since 1990 introduction of phosphate removal at sewage treatment works is introduced .
It is expected that the policy objective for phosphorus will be reached which means a 50 % reduction of phosphorus discharges to surface water is anticipated in the period 1985-1995, despite the fact that run off and leaching from phosphate saturated soils will increase in the same period.

In the period 1985-1990 a 5% reduction of nitrogen discharges to surface waters was estimated. Agriculture with 68% the main source of nitrogen discharges is the main problem. Preliminary calculations indicate a reduction of 30% of nitrogen discharges to surface waters in the period 1985-1995.
These estimates show that the policy objective for the reduction of nitrogen in the period 1985-1995 can not be anticipated, mainly due to a limited reduction in the sector agriculture.

Further measures to reduce nitrogen emissions from agriculture are currently under consideration. Although the direct effect of these additional measures will be limited they would lead to a 40% reduction of nitrogen surplus in 1995 when implemented. Preliminary calculations show that this would lead to a 40% reduction of the discharges of nitrogen to the Dutch surface waters in 2000.

An other problem is the introduction of nitrogen removal at sewage treatment works which will be realised soon after 1995 (before 1998).
This delay of two years will have only a minor effect on the total reduction of nitrogen loads to surface waters, because municipal waste water accounts only for 14% of the total nitrogen load to the surface waters.