

# The North Sea Declaration - Analysis of Measures to Reduce Nutrient Inputs

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The State Pollution Control Authority (SFT) has analysed how Norway can achieve the reduction in nutrient inputs as stated in the North Sea Ministerial Declaration in the most cost-effective way, and at the same time achieve the greatest possible improvement in water quality along the Norwegian coast and in watercourses.

The objective of the analysis was to find alternative combinations of measures that result in:

1. A 50 percent reduction of nutrient inputs at the lowest possible cost.
2. A 50 percent reduction as above, but all measures also result in local improvement of water quality.

A model for selection of the optimal set of measures and ranking of measures was developed. The model (linear programming) selects the combination of measures which result in the desired reduction of phosphorus and nitrogen inputs at the lowest possible cost.

The costs and effects (reduced inputs of N and P) of a number of measures within the main pollution sectors, agriculture, municipal waste water, industry and fish farming were estimated. To compare measures within several sectors, annual costs were used.

Two alternative sets of measures were analysed and reviewed. The lowest-cost alternative that is possible to implement in practice, and which also meets the requirements of the North Sea Declaration, would have average annual costs of about NOK 930 million. The total investments are estimated at about NOK 4,000 million. However, this set of measures does not take account of local water quality, and measures would therefore not always be introduced where the need is most pressing.

An alternative set of measures, in which almost all measures also help to achieve local goals for water quality, has been proposed. The measures in this alternative will result in substantial improvements in pollution status with respect to nutrient loads and eutrophication problems. This set of measures will have average annual costs of about NOK 980 million. The total investments are estimated at about NOK 4,100 million.

Implementation of the proposed measures will reduce the inputs of phosphorus by 50 percent and nitrogen by 44 percent in 1995. A reduction of inputs of nitrogen of about 50 percent will be achieved in 1998. There is, however, uncertainty connected to the implementation feasibility of some of the proposed measures, especially in the agricultural sector.

The Norwegian population's willingness-to-pay for improved water quality and for measures to comply with the North Sea Declaration has been investigated. Taking into account the uncertainties associated with this type of investigation, the results indicate that the Norwegian population are willing to accept the necessary increases in sewage taxes. The investigation indicates that the Norwegian population as a whole is willing to pay NOK 1,500 - 3,000 million per year, and the population of the geographical areas covered by the action plan about 800 - 1,600 million per year.