10 Petroleum operations and the environment

Emissions to the air

Discharges to the sea

National measures

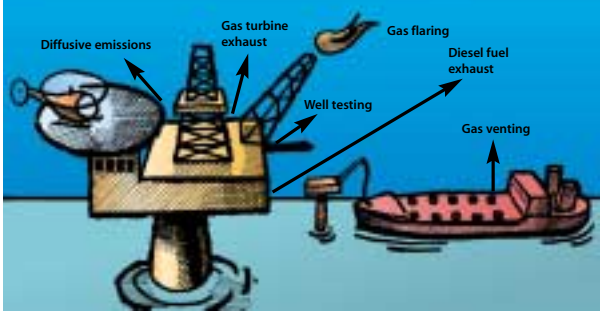

Figure 10.1 Emissions to the air.

Emissions to the air and discharges to the sea by the petroleum sector derive from such activities as exploration, development, production and transport of oil and gas. All these operations are necessary stages in oil and gas production. Emissions from Norway's petroleum business will therefore be determined to some extent by the level of activity, but continued technological progress and further optimisation of operations could help to loosen the tie between emissions and activity. Achieving this goal for carbon dioxide represents the biggest challenge.

The various emissions from offshore operations contribute to different environmental problems. Carbon dioxide and methane add to the greenhouse effect, while nitrogen oxides can lead to eutrophication (over-fertilising), acidification and - in combination with non-methane volatile organic compounds (nmVOC) - the formation of ground-level ozone. In addition, the long-term impact of oil and chemical discharges on marine life is a cause for concern.

Studies have shown that emissions per unit produced are low off Norway compared with similar operations in other countries. The exception is nmVOC emissions, which are relatively high on the NCS because of extensive offshore loading.

Norway's offshore operations are subject to a strict regime which ensures that this industry takes account of environmental considerations. These requirements build partly on obligations accepted by the country through international environmental agreements, and partly on purely national environmental targets.

Emissions to the air

Figure 10.1 shows the most important sources of air pollution from offshore installations. Emissions consist primarily of carbon dioxide (27 per cent), nitrogen oxides (23 per cent), nmVOCs (64 per cent) and methane, and are substantial on a national scale for the first three of these sources. Figures in brackets represent the respective shares of Norwegian emissions in 2000.

Offshore carbon dioxide and nitrogen oxide emissions derive mainly from energy generation on the installations, where natural gas represents the most commonly-used fuel. Some diesel oil is also used. This means that more energy-efficient production, combined with greater efficiency in power generation, is important for efforts to limit this type of emission.

No technology is available today which can help to achieve a significant reduction in carbon dioxide emissions at a cost lower than the present carbon tax. On the other hand, increasing use is being made of low nitrogen oxide burners which can reduce emissions by up to 90 per cent per turbine.

Energy requirements for Norwegian offshore production are expected to rise in the future, both because transport distances to market will increase as more northerly gas resources come on stream and because the major oil fields are maturing and entering a phase of declining output. Since treatment and transport of produced gas is more energy intensive than liquids production, the increase in Norwegian gas exports also boosts energy demand.

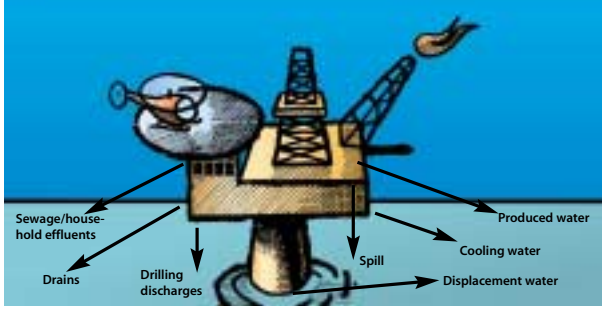

Figure 10.2 Discharges to the sea.

When a field matures, its water cut increase - in other words, the volume of produced water as a proportion of total production goes up. A large part of an installation's energy requirements are independent of the level of production, and energy demand also depends on the total well-stream (oil, gas and water) rather than the output of hydrocarbons. This helps to boost energy consumption per unit produced.

Gas flaring also emits carbon dioxide and nitrogen oxides. Resource management concerns mean that flaring has long been kept at a low level off Norway, but it is still possible to reduce emissions from flaring even further. Recycling flare gas, extinguishing the pilot flame on a number of fields and further improvements to operating routines are among the available methods.

Most nmVOC emissions by the offshore industry derive from vaporisation during offshore storage and loading of crude oil. New technology has now been developed which allows an estimated 70 per cent of such emissions to be recovered. NmVOC emissions are expected to decline substantially because recovery equipment will be installed in line with government regulations.

Discharges to the sea

Figure 10.2 shows the principal sources of discharges to the sea from petroleum operations. The most important of these are chemicals, oil and other organic compounds. Produced water brought up from the reservoir along with oil and gas is the principal source of oil discharges to the sea. Despite extensive treatment, small oil droplets remain when this water is discharged. Oily drill cuttings and drilling fluids, which earlier accounted for a substantial proportion of oil discharges by the offshore industry, are now injected beneath the seabed or taken ashore for further treatment.

Produced water is also being injected back below ground on a growing number of fields. Other methods for limiting volumes of produced water are under development or being tested. In addition, small amounts of oil are discharged from storage cells in the big concrete gravity base structures, and in coolant water. Discharges also occur in connection with accidents and spills.

Many types of chemicals are used to keep petroleum operations stable and secure. The bulk of chemical discharges derive from drilling operations, but residues of production chemicals are also present in produced water.

Most of the chemicals consist of substances which form natural components in seawater or soil. The use of chemicals is strictly controlled, and little or no environmental impact has been documented for most of the substances discharged.

Continuous efforts are being made by the industry to replace environmentally-harmful chemicals with less hazardous substances. Chemicals which are bio-accumulative or have disruptive effects on hormones will be phased out.

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Relevant international environmental agreements

International environmental problems demand measures at both national and international levels. Without a set of international agreements, national efforts to tackle global or regional environmental problems might be relatively ineffective or virtually useless.

Norway has concluded several international agreements and accepted obligations which also create a framework for offshore operations through their impact on markets for oil and gas as well as their requirements for national regulation of emissions.

Adopted at the Rio conference in 1992, the UN framework convention on climate change came into force in 1994. While key principles are enshrined in the convention, binding obligations for the industrial countries were first established in the Kyoto protocol of December 1997. This specifies quantified and scheduled emission restrictions for greenhouse gases.

The industrialised nations must collectively reduce their annual greenhouse gas emissions in 2008-12 by at least five per cent compared with the 1990 level. Their national obligations can be met both through domestic action and by measures in other countries. The latter can involve the Kyoto mechanisms – international emission trading, clean development and joint implementation – and should be a supplement to national measures.

Protocols have been adopted under the 1979 convention on long-distance transboundary air pollution of the UN Economic Commission for Europe (ECE) to regulate emissions of nitrogen oxides and nmVOCs. Under the prevailing nitrogen oxide protocol, Norwegian emissions must be lower after 1994 than they were in 1987. This obligation is currently being met by Norway.

The requirement for nmVOC was that emissions from the entire mainland and the Norwegian economic zone south of the 62nd parallel should be reduced by 30 per cent from the 1989 level in 1999. Norway failed to meet this commitment by the deadline, but the requirements now imposed for nmVOC will allow it to be fulfilled once the relevant measures have been implemented.

Emissions of nitrogen oxides, nmVOC, sulphur dioxide and ammonia are regulated by the Gothenburg protocol adopted in 1999. Its provisions require Norway to reduce nitrogen oxide emissions to 156 000 tonnes by 2010, corresponding to a 29 per cent cut from the 1990 level. The commitment for nmVOC is virtually unchanged from the one accepted by Norway under the existing VOC protocol. In addition, national emissions must not exceed 195 000 tonnes per year.

The most important international agreement regulating discharges to the sea is the convention for the protection of the marine environment of the north-east Atlantic (Ospar).This convention aims to prevent pollution of these waters and to protect them from being harmed by human activities. Ospar's ministerial meeting in 1998 resolved that redundant offshore structures in the area covered by the convention must be removed.

Concrete installations and certain parts of large steel structures are excluded from this

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requirement. The commission meeting in 1999 adopted a strategy for offshore oil and gas operations.

Relevant European Union directives adopted in the European Economic Area will also contribute to shaping Norwegian environmental policies.

National measures

Impact assessments

Norway's Petroleum Act calls for environmental impact assessments to be carried out as part of the input for decision-making at several stages in petroleum operations. Such studies are required before an area is opened to exploration, in connection with field and transport system developments, and when disposing of abandoned installations.

The MPE is responsible for ensuring that environmental impact assessments are performed before an area is opened for the award of exploration licences. Because the issue of opening new areas ranks as very important in terms of an overall social evaluation and for local interests, it calls for comprehensive and detailed consideration. An impact assessment is intended to clarify the environmental consequences of petroleum operations and possible pollution threats as well as the economic and social effects which could follow from the exploitation of petroleum reserves in the area.

On the basis of such an assessment, the Storting (parliament) undertakes an overall assessment of the advantages and disadvantages of pursuing petroleum operations in an area. Exploration will not be permitted where the disadvantages are greatest. Both Storting and government can also impose special conditions on an area, such as prohibiting drilling in certain periods.

An environmental impact assessment must have been carried out when an operator seeks official approval of development plans (PUD/PIO) for field installations, transport or landfall pipelines and other petroleum facilities. This assessment must include a description of the environmental effect of expected emissions from the project, and must review the cost-benefit of alternative measures for reducing this impact.

The assessment is circulated widely for comment to ensure that all consequences of a project are identified as fully as possible. Measures to be implemented are determined as part of the final approval of a project by the Storting or the government.

Before a licence expires or an installation is abandoned, the licensees must submit a decommissioning plan. This has to be accompanied by an impact assessment covering relevant methods for disposing of the installations concerned. The authorities will consider the plan before reaching an abandonment decision.

Carbon dioxide tax

By virtue of the Act imposing taxes on carbon dioxide emissions from offshore petroleum operations, a tax on burning fossil fuels - primarily natural gas and diesel oil - which emit carbon dioxide was introduced with effect from 1 January 1991. From 1 January 2002, this tax is levied at a rate of NOK 0.73 per litre of oil/scm of gas.

Pollution Act

Discharges to the sea from petroleum operations are regulated under the authority of the Pollution Act.

The principal rule applied when approving new free-standing developments off Norway is that they discharge no environmentally-hazardous substances to the sea (zero discharge). Measures on existing installations will also be assessed in the light of a zero discharge philosophy.

From the autumn of 2000, the release of nmVOCs from crude oil storage and loading has been regulated under the Pollution Control Act.

Cooperation with the industry

The strong focus on environmental aspects of Norwegian oil and gas production has undoubtedly put Norway's petroleum business up with the front runners in this area.

That reflects not only the way the authorities have taken environmental considerations very much into account when formulating policies for the sector, but also the industry's commitment.

At the initiative of the oil industry, the Miljøsok collaboration was established by the MPE in 1995. Its purpose is to strengthen and extend cooperation between the industry and the authorities so that Norway's petroleum industry can continue to lie in the international forefront for environmentally-appropriate and cost-effective operation.

Miljøsok's members have included research institutes, the petroleum industry, environmental organisations, fishery interests and relevant government agencies.

The second phase of this collaboration was concluded in 2000 with a report which included recommendations on how to continue the cooperation between industry and the authorities. Work is now under way to follow up these recommendations, in part through a new Environment Forum established to follow up Miljøsok. This body held its first meeting in the autumn of 2001.