

10 Petroleum operations and the environment



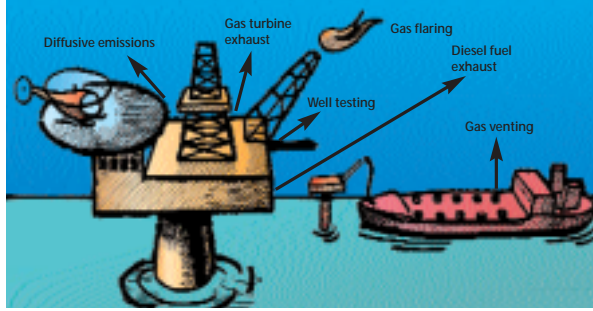


Figure 10.1 Emissions to the air.

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 (28 per cent), nitrogen oxides (23 per cent), nmVOCs (66 per cent) and methane, and are substantial on a national scale for the first three of these sources. The figures in brackets represent the respective shares of Norwegian emissions in 2001.

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.

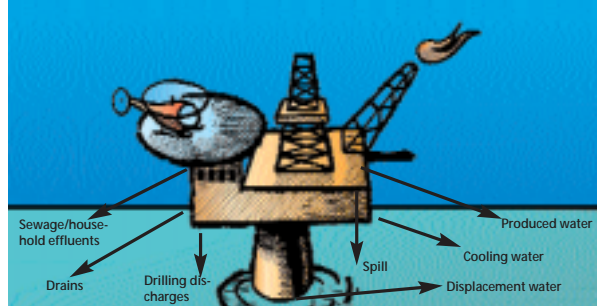


Figure 10.2 Discharges to the sea.

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 wellstream (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 - primarily through improved operating routines.

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 substan-

tial 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 into the 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 of 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.

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 1997.

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

In addition to various international environmental agreements, European Union directives relevant to the European Economic Area will also provide guidelines for Norwegian environmental policies.

National measures

Impact assessments are carried out before areas are opened for exploration and when seeking government approval of development plans (PDO/

PIO). Such studies represent an important instrument for ensuring that environmental aspects are taken into account by possible petroleum activities in an area. More details about impact assessments are provided in chapter 3, Regulatory framework.

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 2003, this tax is levied at a rate of NOK 0.75 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.

A zero discharge target has been set for the NCS, which means that no environmentally-hazardous substances should as a general rule be discharged to the sea from petroleum operations. This target applies immediately for new stand-alone developments, and from 31 December 2005 on existing installations.

The release of nmVOCs during crude oil storage and loading is 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 Miljø-sok collaboration was established by the MPE in 1995. It has been continued by a new collaborative body, the Environmental Forum. The aim 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.

The Environmental Forum's members have included research institutes, the petroleum industry, environmental organisations, fishery interests and relevant government agencies. Further details about the forum's work can be found on the www.olf.no web site.

