The Norwegian Petroleum Directorate
Annual Report

Offshore Norway 2000

UNITS OF MEASUREMENT FOR OIL AND GAS

Oil and gas are often stated in volumetric units under defined ISO standard conditions (temperature = 15°C and pressure = 1.01325 bar). Oil volumes are stated in million Sm≈ (10^6 Sm^3) and gas volumes in billion Sm≈ (10^9 Sm^3).

Oil and gas volume units are converted to oil equivalents when adding or comparing oil and gas resources and when an exact figure for the quantity is not needed.

The conversion to *oil equivalents* is based on the amount of energy that is released during oil and gas combustion.

As of 1 January 1996 the Norwegian Petroleum Directorate states the total petroleum resources in Sm≈ oil equivalents (Sm^3 o.e.). The following conversion factors are used for conversion to Sm^3 o.e.:

1 000	Sm^3 gas is equivalent to:	1 Sm^3 o.e.
1	Sm^3 oil is equivalent to:	1 Sm^3 o.e.
1	Tonne NGL is equivalent to:	1,9 Sm^3 o.e.
1	Sm^3 condensate is equiv. to:	1 Sm^3 o.e.

For conversion of NGL from tonnes to Sm^3 o.e., a factor of 1.3 tonnes/Sm^3 o.e. has previously been used. This has now been changed to 1.9 tonnes/ Sm^3 o.e.

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The Norwegian Petroleum Directorate's function and activities

The Norwegian Petroleum Directorate was established in 1972 and performed about 355 man-years of work in 2000. The Directorate reports to the Ministry of Petroleum and Energy with regard to resource management and administrative matters, and to the Ministry of Local Government and Regional Development for matters relating to safety and working environment. Within the area of CO_2 tax, the Directorate exercises authority on behalf of the Ministry of Finance.

The Norwegian Petroleum Directorate shall contribute to ensuring that the resources on the Norwegian shelf create the greatest possible value. In addition to revenues for the State, the value concept also encompasses the general welfare, a good, sustainable environment and the premise that the activities are conducted in accordance with a framework of social ethics. Therefore, the Norwegian Petroleum Directorate is concerned with ensuring that its efforts in the areas of resource management and health, safety and the environment will constitute a comprehensive contribution towards creating these values for society as a whole.

The work on the organizational development project "NPD 2000 and beyond" has gone on throughout the year. The objective is to develop a more unified and effective Directorate that can better meet the challenges in the petroleum activities in the future and contribute to creation of value in the Norwegian society. After the assumptions and premises for the new organization were concretized during the first half of 2000, a new organizational model was prepared during the course of the autumn of 2000. The new organization was implemented as from 1 January 2001 and represents a transition from a traditional organization to an organization that is flat and based on flexible, inter-disciplinary and interactive teams organized around prioritized products.

Resource situation

Norway still produces more oil than we discover each year, and we find considerably more gas than we export. Since 1996, oil production has maintained a stable level of 2.9 - 3.2 million barrels per day. It is expected that the oil production will remain at this level or slightly higher for the next three - four years, after which a gradual reduction is anticipated. Gas exports, however, are experiencing strong growth, and have nearly doubled since 1995. Based on sales agreements signed with customers on the Continent, gas exports will continue to increase at the same pace for the next four - five years.

A total of ten discoveries were made on the Norwegian shelf during 2000. In keeping with the development trend in recent years, the most and largest discoveries are made in the Norwegian Sea, and the discoveries contain considerably more gas than oil. Several of the discoveries are significant in terms of size, also compared with the current international discovery portfolio. Therefore, there continues to be great interest in discovery activities in the Norwegian Sea. In 2000, wildcat wells were drilled in the Barents Sea for the first time since 1994. The discovery of oil and gas in two of the wells contributes to creating optimism with a view towards continued exploration and new discoveries in these northern waters.

In addition to gas export, an increasing percentage of produced gas is used for injection to improve the recovery rate in oil and condensate fields. The authorities' goal is to improve the recovery rate for oil on the Norwegian shelf from today's 44 per cent to 50 per cent. Therefore, the Norwegian Petroleum Directorate has continuous focus on measures that can enhance oil recovery on the shelf, and envisages a situation where gas injection volumes will continue to increase in the next few years.

In spite of the fact that less petroleum was discovered in 2000 than was produced, the estimate for total recoverable reserves on the Norwegian shelf has increased compared with the previous year. This is mainly due to an upward adjustment of the estimates for undiscovered resources in the Norwegian Sea, as well as somewhat higher resources in established fields and discoveries.

Activity level

Investments on the Norwegian shelf in 2000 amounted to about NOK 52 billion, a decline of 24 per cent compared with 1999. This is nevertheless substantially higher than expected at the beginning of the year. A stable, high oil price throughout the year led to a greater willingness to invest on the part of the companies, so that the future prospects also appear to be brighter compared with one year ago. Investments in 2001 have been estimated to be at the same level as in 2000, with a subsequent anticipated decline to the level of NOK 30 - 40 billion for a few years. The uncertainty is linked, among other things, to the issue of whether gas marketing opportunities will materialize more rapidly than indicated in the forecasts. This will lead to a need for investments in new pipelines and possibly terminals.

The external environment

The environment receives significant attention and cooperation with the Norwegian Pollution Control Authority, Miljøsok and others continues. In 2000, the Norwegian Petroleum Directorate, in cooperation with the Norwegian Pollution Control Authority, carried out one supervision audit that was specifically aimed at the operators' safeguarding of the external environment. Otherwise, the work on measures in relation to exploration drilling in environmentally sensitive areas has received special attention.

The Norwegian Petroleum Directorate prepares annual forecasts for emissions of CO_2, NO_x, volatile organic compounds (nmVOC and methane) and produced water. The forecasts are an important basis from which to evaluate policy instruments so that national and international commitments may be followed up in a cost-effective manner.

Health, safety and the environment

Unfortunately, there were two fatal accidents in 2000 in or in connection with the petroleum activities. One of the accidents led to a person losing his life in connection with a crane lift. In this incident also, the investigation has shown that technical failure was not the cause of the accident, but rather unclear lines of responsibility and violation of procedures and good practice for such operations. The Directorate takes a serious view of what appears to have become an established culture where violation of regulations and procedures has been incorporated in normal practice, and thus accepted.

The circumstances surrounding this accident coincide with other conclusions drawn from the Directorate's supervision and audits, and which indicate that the companies' managements are not succeeding in their work to create better attitudes and awareness. One of the causes of this may be a lack of good attitudes in the management team that is to create good attitudes throughout the entire organization. Therefore, the Directorate will place increased emphasis on supervision audits and other measures that can help to bring about positive attitudes towards health, safety and the environment.

The other fatal accident occurred on an anchor-handling vessel where a roughneck died of injuries he suffered when he was struck by a chain. This accident is being followed up by the maritime authorities, as it occurred on a vessel that is not subject to the authority of the Norwegian Petroleum Directorate. The Directorate will nevertheless review the investigation report with a view towards potential measures across the various involved authorities' spheres of responsibility.

The Directorate has carried out an extensive project in order to achieve the best and most measurable expression of the risk level in the petroleum activities on the shelf. The plan is to continue the project as a continuous activity, thus enabling a determination of how the risk is developing. This type of knowledge will provide the authorities with a better opportunity to prioritize efforts in the best way possible. The results from the project in 2000 support the impression previously gained to the effect that the risk level in the activities is on the rise. It is crucial that measures be instituted that can prevent such a development before the increased risk level results in unacceptable accidents.

Regulatory development

At the end of 2000, the Norwegian Petroleum Directorate had nearly completed its work on further simplification and improvement of the regulations. The new regulations are part of an overall system that also encompasses the simplification of ministerial regulations. When the new regulations enter into force, health, safety and the environment in the petroleum activities will be governed in a comprehensive manner, which represents an administrative milestone. The regulatory work has been carried out in close cooperation with other involved governmental bodies, and the new regulations will form the basis for efficient and comprehensive supervision in the area of health, safety and the environment.

The system of so-called "Acknowledgement of Compliance" (SUT) for mobile installations was implemented in 2000. Among other things, the Directorate hopes that this system will contribute to cost-effective development and operations through preventing unnecessary costs as a result of incorrect interpretation and application of regulatory requirements. The experience so far also seems to indicate that health, safety and the environment receive increased attention from the rig owners as a result of the work involved with applying for such an acknowledgement.

As regards resource management, the work on new Directorate regulations has been continued. Emphasis has been placed on continuing the phase-by-phase development from the Petroleum Act and associated regulations. The regulations have been subject to external consultation in 2000.

In addition to the regulations, a set of topical guidelines is being prepared that will provide explanatory guidelines within certain areas.

The guidelines for plans for development and operations and plans for installation and operations that were prepared under the direction of the Ministry of Petroleum and Energy were completed in 2000.

The goal of the regulatory work is to develop unified regulations that contribute to cost-effective management and good interaction between the petroleum industry and the authorities.

Stavanger, 18 April 2001

Gunnar Berge
Director General

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1.1 INTRODUCTION

The Norwegian Petroleum Directorate must maintain a constant overview of the development within the petroleum activities in order to responsibly fulfill its role as a central advisory and implementation body for the Ministry of Petroleum and Energy.

The petroleum activities in Norway have an enormous income potential, but they also entail substantial direct and indirect expenses. The State's Direct Financial Interest (SDFI) has a significant impact on the state budget. In addition, the tax regime, 28 per cent corporation tax and 50 per cent special tax on profits from petroleum activities on the shelf, entails that the state also carries a substantial part of the risk. Therefore, it is important that the authorities have the professional expertise and the capacity to ask the right questions and follow up ongoing activities.

The petroleum industry is international, with movement of personnel and capital resources across borders for application where they provide the best return. Therefore, the companies must be subject to requirements for expertise and long-term commitment prior to being awarded production licenses and the opportunity to create future income. This became even more apparent in 2000. The faith in higher prices for oil and gas in the future leads to increased activity worldwide. OPEC has strengthened its position, and an oil price of USD 20-30 per barrel appears to be a credible scenario. This means that most of the resources proven in Norway are commercially viable. The same is the case worldwide, and the industry which for many years has built down capacity and dismissed or offered early retirement to employees, is now experiencing that a shortage of expertise and capacity is restricting growth.

Norway's oil and gas assets will also in the future depend on competent milieus recognizing opportunities and creating the confidence needed to execute billion-kroner projects so that the oil and gas resources may be converted into benefits for the public. Therefore it is an important task to promote recruitment and strengthen broad-based research and development activity. The Norwegian Petroleum Directorate is involved together with the Ministry of Petroleum and Energy, the Research Council of Norway, the Norwegian Confederation of Trade Unions, the Norwegian Oil Industry Association, the National Association of Technological Enterprises, and others to give this work the greatest possible importance.

The investments in the petroleum sector are estimated at about NOK 52 billion in 2001, with an expected decline to the level of NOK 30-40 billion for the next several years. This may change, particularly if gas marketing opportunities open up more quickly than indicated in current forecasts. This will lead to a need for investments in new pipelines and possibly terminals. Europe's energy needs are rising, the need for gas appears to be increasing faster than expected and consumption is higher than previously estimated. The national budget forecast for anticipated gas sales is about 90 billion Sm^3. The uncertainties surrounding the EU's gas directive, what it will entail in the various countries that currently buy gas from Norway, and what it will mean for our own system, also led to considerable work for the Norwegian Petroleum Directorate.

Norway still produces more oil than we discover each year, and we find more gas than we export.

The total recoverable resources were adjusted up to 13.8 billion Sm^3 oil equivalents, of which three billion have been produced. Last year's growth was about 150 billion Sm^3 liquid and 250 billion Sm^3 gas. The upward adjustment of the estimates for undiscovered resources in the Norwegian Sea and resources in fields and discoveries also contributed to this growth.

Several major new developments were approved in 2000. The project for improved recovery from Valhall using water injection was approved. Other major developments are Grane, Ringhorne and Kvitebjørn. There is a significant expectation of new development plans in 2001.

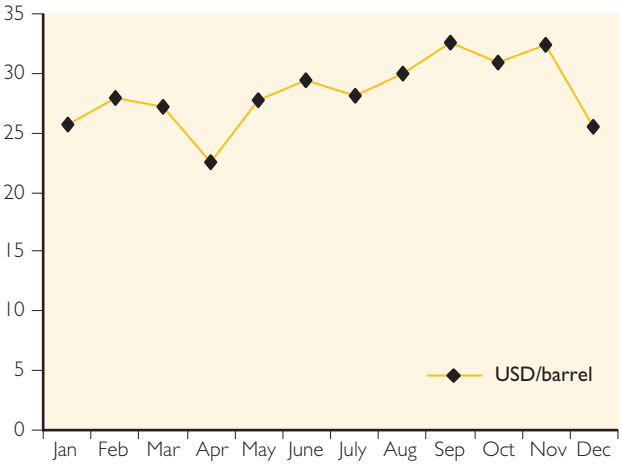
Data cooperation and standardization continue to be commitment areas, and provisions have been made for simplifications within the entire administrative area in the new resource regulations that will probably enter into force during the course of 2001.

The environment is a priority area and the cooperation with the Norwegian Pollution Control Authority and the companies through Miljøsok, etc. continues. Work is underway regarding possible schemes for quota trading and cost-effective methods of meeting the international requirements that Norway has endorsed.

1.1.1. THE CRUDE OIL MARKET

Global oil production in 2000 (excluding NGL) is estimated to be about 67.1 million barrels per day (Source: Oil and Gas Journal (OGJ), 18 December 2000). This is equivalent to 3.9 billion Sm^3 per year and entails an increase of four per cent from 1999. Production from the OPEC countries increased by six per cent, from 26.5 mil-

Figure 1.1.1
Crude oil prices in 2000,
Brent blend, USD/barrel, source IEA



lion barrels per day in 1999 to 28.2 million barrels per day in 2000. Production increased in all OPEC countries. Production outside of OPEC also increased by two per cent, or just under one million barrels per day. Production increased for countries such as Russia, Kazakhstan, Australia and Norway.

Norway's oil production in 2000 was 3.2 million barrels per day. This is equivalent to 4.8 per cent of global production. OPEC's market share was almost 42 per cent, up one percentage point from 1999.

According to OGJ, the world's proven oil reserves at the end of 2000 were 163.5 billion Sm^3, which is an increase of 2 billion Sm^3 during the year (+1.2 %). The largest increase came from Qatar, which has adjusted its estimated reserves from 0.6 to 2.1 billion Sm^3. Based on the resource estimates, the largest oil-producing area in the future will be the Middle East, which has 66 per cent of the world's oil reserves. OPEC's share is 79 per cent. Figure 1.1.1 shows the development of the price of crude oil in 2000. The oil price has remained relatively high during the entire period.

1.1.2 THE GAS MARKET

In 2000, Norway exported gas to the United Kingdom, Germany, the Netherlands, Belgium, France, Spain, Austria and Czechia. Exports amounted to 48.6 billion Sm≈. This is an increase of 3.1 billion Sm≈ (6.8 %) gas from the previous year. The average energy content of the exported gas was 40.4 megajoules per cubic metre.

Organization of Norwegian gas sales

Since 1986, the sale of Norwegian gas has been coordinated by a joint Gas Negotiation Committee (GFU) under the direction of Statoil and with participation by Norsk Hydro and the former Saga. Other companies are also involved in the negotiation of gas sales contracts. In 1993, the authorities set up the Gas Supply Committee (FU). This committee, which consists of the largest gas owners on the Norwegian shelf, has an advisory role vis-à-vis the Ministry of Petroleum and Energy in questions related to development and management of gas fields and transportation systems for gas.

The first gas sales were primarily based on depletion of accessible reserves in the individual fields. Norway entered a new era as a gas supplier on 1 October 1993 when deliveries under the Troll agreements (TGSA) got underway. These are sales contracts which offer the customers fixed annual volumes, where also other fields than Troll may provide deliveries. In connection with the Troll agreements, the authorities have established the Troll commercial model, which provides opportunities for the sale of associated gas and smaller gas fields.

Existing commitments

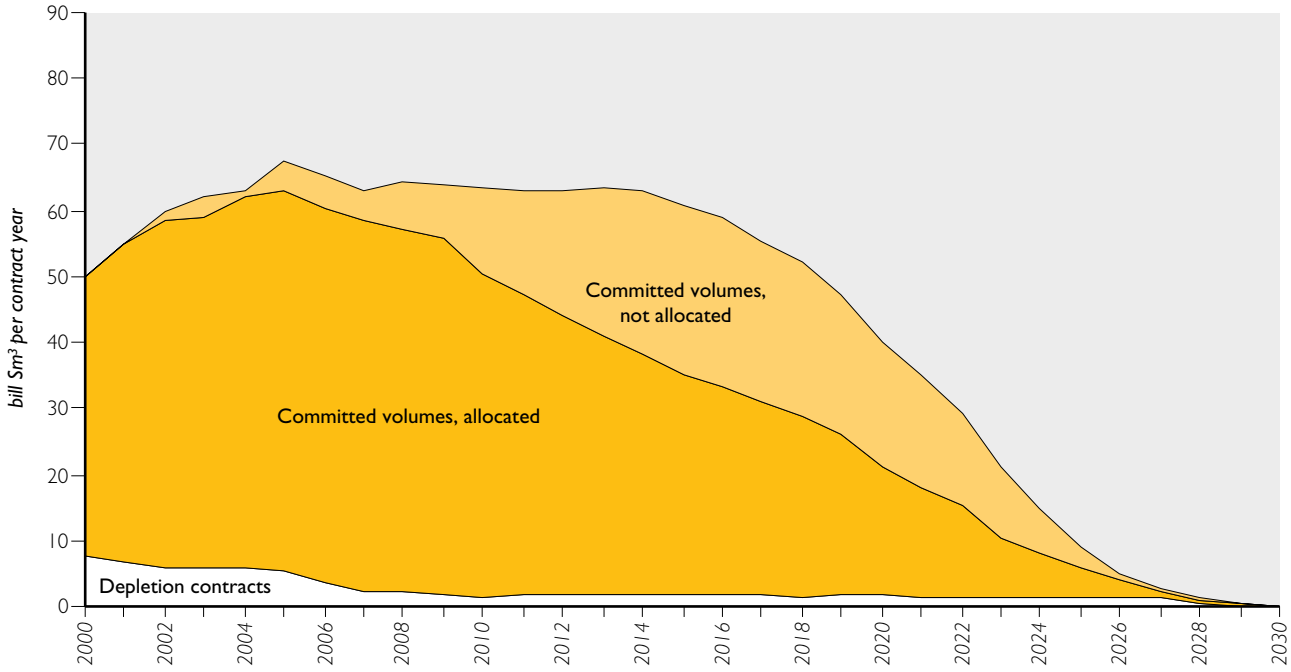
Field contracts

The fields which currently deliver under field contracts are Statfjord, Gullfaks, as well as fields in the Frigg and Ekofisk areas. Production from these fields is now in the decline phase. Gas deliveries from the Ekofisk and Frigg areas started in 1977, from Statfjord in 1985, from Heimdal in 1986 and from Gullfaks in 1987. The gas from the Frigg area is delivered to the United Kingdom, while the other fields deliver to buyers on the Continent.

The Troll Gas Sales Agreements (TGSA)

The TGSA agreements were signed in 1986 between the Troll licensees and buyers on the Continent. The buyer countries are Germany, the Netherlands, Austria, France, Belgium and Spain. Subsequently, other agreements have also been included in TGSA.

Figure 1.1.2
Committed sales of gas



Newer commitments
In 2000, an agreement was signed for the sale of injection gas to the Grane field. In addition, several agreements regarding short-term sales were signed with time frames ranging from one day to several months.

Potential new sales
Over time, it is expected that Norway's total gas sales may reach approx. 90 billion Sm≈ per year.

Figure 1.1.2 shows committed gas sales. Committed volumes are divided between field contracts, allocated supply contracts and non-allocated supply contracts. The Ministry of Petroleum and Energy allocates volumes after consultation with the Norwegian Petroleum Directorate and the Gas Supply Committee.

Use of gas in Norway
The most important Norwegian gas market is the market for injection gas on the continental shelf. The gas is injected in order to achieve improved oil recovery. The largest consumers are Oseberg, Åsgard, Statfjord, Gullfaks, Njord, Snorre, Visund and Grane. Primarily gas produced from the field itself is used for these purposes. The most important exceptions are Oseberg and Grane, which import significant volumes of injection gas from other Norwegian fields. Gas is also the most important source of energy for operation of field and transportation systems. In 2000, a total of 35.4 billion Sm^3 gas was used for injection and 3.0 billion Sm^3 was used as fuel on the shelf.

Gas has been landed in Norway since Statpipe began operations in 1985. The gas is landed at Kårstø in northern Rogaland, at Kollsnes in Hordaland and Tjeldbergodden in Møre og Romsdal.

In 1994, Statkraft, Statoil and Norsk Hydro set up a joint company, Naturkraft. Naturkraft has obtained a license for development and operation of two gas power plants. The plan is for the power plants to be established at Kårstø and Kollsnes. Total consumption of gas in the planned gas power plants will be 0.9 billion Sm≈ gas per year.

In addition, plans were presented in 1999 for the construction of a power station in Skogn in Nord-Trøndelag. Planned gas consumption is 1.1 billion Sm^3 per year.

In 1997, methanol production was started at Tjeldbergodden. Total gas consumption is 0.7 billion Sm^3 per year. In northern Rogaland, an agreement has been signed regarding smaller deliveries to the distribution company Gasnor. Deliveries commenced in 1994. The company Naturgass Vest has started developing a distribution network for natural gas from Kollsnes in Øygarden. During the course of 2000, production of compressed gas got underway for use in vehicles and for industrial customers.

1.2 REGULATIONS

As regards resource management, the work on two new regulations has been continued. The two new regulations will replace the previous regulatory provisions at the directorate level. The regulations consist of one main regulation that will cover all phases of the petroleum activities and a new regulation relating to metering that will synthesize the current regulations relating to fiscal measurement and the regulations relating to measurement of fuel and flare gas for calculation of CO_2 tax. Emphasis has been placed on continuing the phase-by-phase development from the Petroleum Act and associated regulations. The regulations have been subject to external consultation in 2000.

In addition to the regulations, a set of topical guidelines are being prepared that will provide explanatory guidelines within certain areas. Examples include guidelines for resource classification, guidelines for digital data reporting and guidelines for annual status report for fields in production.

The guidelines for plans for development and operations and plans for installation and operations that were prepared under the direction of the Ministry of Petroleum and Energy were completed in 2000.

The goal of the regulatory work is to develop unified regulations that contribute to cost-effective management and good interaction between the petroleum industry and the authorities. Regulatory information may be found at www.npd.no.

1.2.1 DELEGATIONS IN THE RESOURCE MANAGEMENT AREA

The duties of the Norwegian Petroleum Directorate are set out in the special instructions of 1 October 1992. Duties have also been assigned to the Norwegian Petroleum Directorate by delegation of authority. Such authority is delegated either directly pursuant to acts/regulations or by individual delegation decisions by a superior authority. The following delegations of authority apply in the area of resource management:

a) The Petroleum Act of 29 November 1996, No. 72
   Including:
   The Petroleum Regulations, Royal Decree of 27 June 1997
   The Petroleum Register Regulations, Royal Decree of 19 June 1997
b) The CO_2 Act of 21 December 1990, No. 72
c) Regulations relating to scientific research for natural resources on the Norwegian continental shelf, etc., Royal Decree of 31 January 1969

1.3 RESOURCE ACCOUNTING

The Norwegian Petroleum Directorate's resource accounting includes an overview of both the original marketable and remaining petroleum volumes on the Norwegian continental shelf. Changes in the resource accounting are inter alia due to new discoveries or that the resource estimates for existing fields and discoveries are adjusted based on new surveys or new production technology. The remaining resources are also reduced by production.

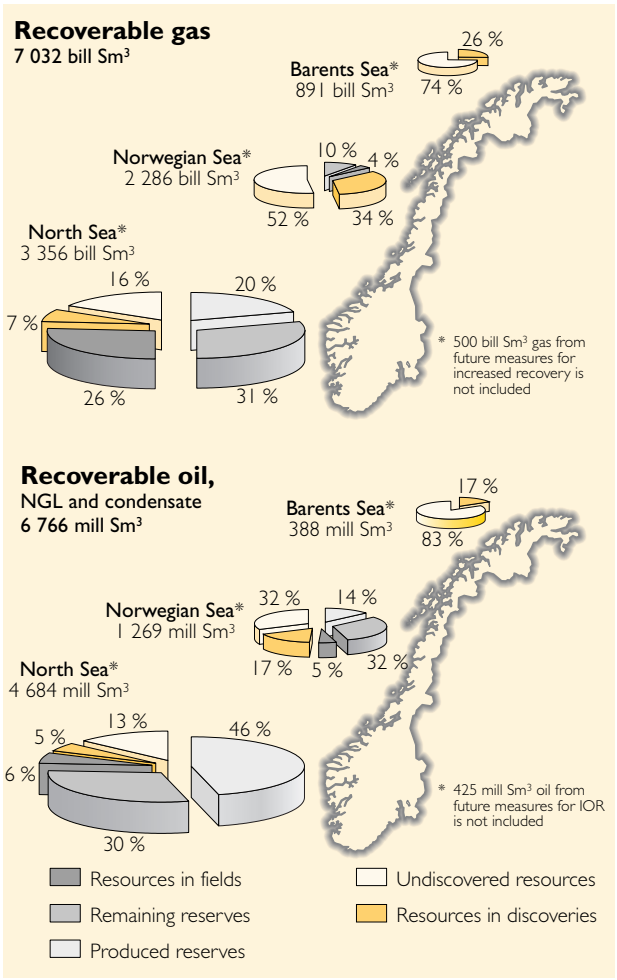
The resource accounting is based on four products: oil, gas, condensate and NGL. This was first done in 1998. Therefore, a comparison of the reporting with years prior to 1998 will not be appropriate for individual products.

1.3.1 THE RESOURCE CLASSIFICATION SYSTEM

The Norwegian Petroleum Directorate's resource classification system divides the resources into 12 different resource classes. Resource Classes 0 to 7 are for the discovered, recoverable resources, Resource Class 8 is for the resources from potential future measures to improve the recovery factor and Resource Classes 9 to 11 are for undiscovered resources. The resource classes are:

Resource Class 0: Reserves where production has ceased
Resource Class 1: Reserves in production
Resource Class 2: Reserves with an approved development plan
Resource Class 3: Resources in the late planning stages (PDO approval within 2 years)
Resource Class 4: Resources in the early planning stages (PDO approval within 10 years)
Resource Class 5: Resources that may be developed in the long term
Resource Class 6: Resources where development is not very likely
Resource Class 7: Resources in new discoveries where evaluation is not complete
Resource Class 8: Resources from possible future measures to improve recovery rate (measures which are not planned, possibly exceeding present-day technology)
Resource Class 9 Resources in prospects
Resource Class 10: Resources in leads
Resource Class 11: Unmapped resources

Figure 1.3.1
Geographical distribution of petroleum resources on the Norwegian continental shelf



The main principle in the classification system is that the original recoverable reserves in a field or a discovery shall be classified according to where they are located in the development chain from when a discovery is made, or a new measure to increase the recoverable resources in a field is identified, and up to when the production of the resources is complete. The system takes into account that a field or a discovery may have resources in several classes, i.e., resources of varying maturity in the development chain.

Resources is a generic term used for all types of petroleum volumes.

Reserves comprise recoverable resources in accordance with approved plans for fields in production and for fields under development. In other words, reserves are

Figure 1.3.2
Uncertainty in estimates of petroleum resources

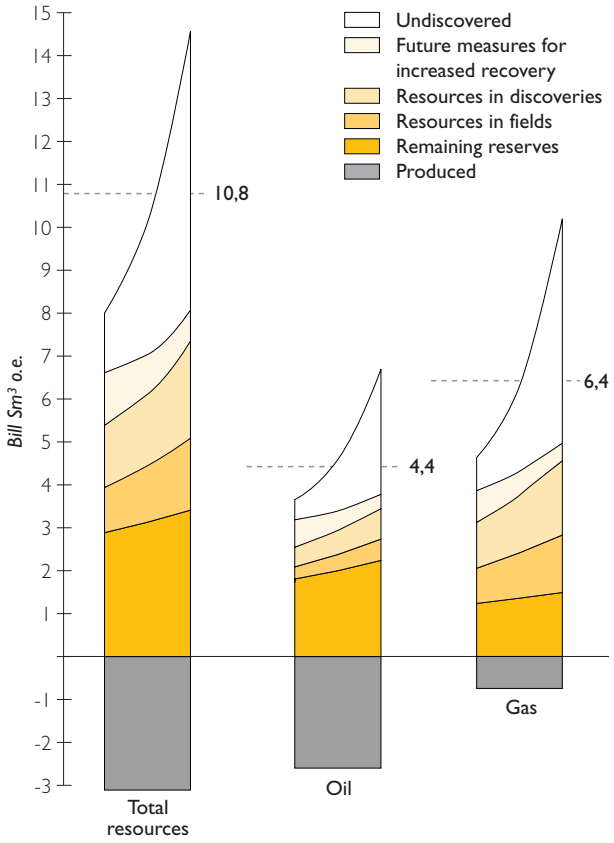


Table 1.3.1 Total petroleum resources on the Norwegian continental shelf

Resource Class		Oil Million Sm^3	Gas Billion Sm^3	NGL Million tonn	Condensate Million Sm^3	o.e.[2] Million Sm^3
	FIELD					
	Reserves					
0	Ceased production	32	114	4	1	154
1,2	In production or approved PDO	3719	1822	124	141	5917
	Total reserves	**3751**	**1937**	**127**	**142**	**6072**
	Sold as of 31 December 2000	2187	677	52	41	3004
	Remaining reserves	1564	1259	75	101	3067
	Resources related to fields					
3	Late planning stages	102	111	6	0	224
4	Early planning stages	129	751	24	10	937
5	May be developed over the long term	19	62	4	0	89
6	Development unlikely	12	13	2	0	29
	Total	**262**	**937**	**36**	**10**	**1279**
	Total field	**4013**	**2874**	**164**	**152**	**7351**
	DISCOVERIES [1]					
	Resources related to discoveries					
3	Late planning stages	92	348	29	98	593
4	Early planning stages	21	487	10	38	565
5	May be developed over the long term	94	267	1	29	392
6	Development unlikely	40	61	2	4	108
7	New discoveries/evaluation incomplete	20	95	0	0	115
	Total	**266**	**1258**	**41**	**169**	**1772**
8	Possible measures to improve oil recovery	425	500			925
9,10,11	Undiscovered resources	1350	2400			3750
	Total recoverable	**6054**	**7032**	**205**	**322**	**13798**
	Sold as of 31 December 2000	2187	677	52	41	3004
	Remaining	**3867**	**6355**	**153**	**280**	**10793**

[1] Discoveries in Resource Classes 3 and 4 also contain resources in higher resource classes; Therefore, the volumes are not directly comparable with the volumes in Tables 1.3.5 and 1.3.6.

[2] 1.9 is the conversion factor for NGL in tonnes to Sm^3

distributed among the first three resource classes. A distinction can be made between original recoverable and remaining reserves.

A *deposit* is an accumulation of petroleum in a geological unit, delimited by rocks with structural or stratigraphic boundaries, contact surfaces between petroleum and water in the formation, or a combination of these, so that the petroleum concerned is in continuous pressure communication through fluid or gas.

A discovery is a deposit or several deposits together which were discovered in the same wildcat well and which through testing, sampling or logging, has shown probable mobile petroleum.

A *field* is one or more discoveries together which are covered by an approved Plan for Development and Operation (PDO) or have been granted an exemption from the PDO requirement.

There is only one discovery well for each discovery. This means that new exploration wells that prove resources that are part of or will be incorporated in the resource estimate for an existing discovery are not regarded as being new discovery wells. The discovery year is the year the discovery well was temporarily abandoned or completed.

Resource Class 8 comprises the oil and gas volume that could have been recovered in addition to the resources included in the present fields and discoveries if the average future recovery rate is 50 per cent for oil and 75 per cent for gas.

Undiscovered resources comprise both mapped prospects (Resource Classes 9 and 10) and unmapped resources in areas where plays have been defined (Resource Class 11). There is always great uncertainty connected with analyses of undiscovered resources. The size stated for undiscovered resources is the statistical expected value.

Table 1.3.2 Reserves in fields where production has ceased (Resource Class 0) [1]

Field	Oil	Gas	NGL	Condensate	Oil equivalents [2]	Discovery
	Million Sm^3	Billion Sm^3	Million tonnes	Million Sm^3	Million Sm^3	year [3]
Albuskjell	7,4	15,9	1,0	0,0	25,2	1972
Cod	2,9	7,5	0,5	0,0	11,4	1968
Edda	4,8	2,1	0,2	0,0	7,3	1972
Lille-Frigg	0,0	2,3	0,0	1,3	3,6	1975
Mime	0,4	0,1	0,0	0,0	0,5	1982
Nordøst Frigg	0,0	11,6	0,0	0,0	11,7	1974
Odin	0,0	29,3	0,0	0,0	29,3	1974
Tommeliten Gamma	3,9	9,2	0,6	0,0	14,2	1978
Vest Ekofisk	12,2	26,9	1,4	0,0	41,8	1970
Øst Frigg	0,0	9,4	0,0	0,1	9,4	1973
Total	**31,6**	**114,3**	**3,8**	**1,4**	**154,3**	

1) Original recoverable reserves in fields where production has ceased is equivalent to the volume delivered. Any remaining recoverable resources are included in the appropriate resource classes.
2) 1.9 is the conversion factor for NGL in tonnes to Sm^3
3) Discovery year is defined as the year of the oldest discovery well included in the field

1.3.2 RESOURCE ACCOUNTING FOR 2000

The estimated total for original recoverable resources on the Norwegian shelf is 13 798 million Sm^3 oil equivalents (o.e.). 6071 million Sm^3 o.e. (44 %) has already been developed or is approved for development. Of this total, 3005 million Sm^3 o.e. has been produced. This means that there are 3067 million Sm^3 o.e. remaining reserves in fields. In discoveries not yet approved for development, the total recoverable resources are 1772 million Sm^3 o.e. (about 13%). The undiscovered resources are estimated at 3750 million Sm^3 o.e. (27 %) and resources from potential future measures to increase the recovery factor are estimated at 925 million Sm^3 o.e. (7 %).

The complete resource accounting for the Norwegian continental shelf is shown in Table 1.3.1 and the geographical distribution of the resources is shown in Figure 1.3.1. The uncertainty in the estimates of the petroleum resources is shown in Figure 1.3.2.

1.3.3 RESOURCE STATUS

Fields where production has ceased

There were no fields that ceased production in 2000. The number of fields on the Norwegian continental shelf where production has ceased is now ten. Original recoverable reserves in these fields (Resource Class 0) are shown in Table 1.3.2.

Reserves in fields which are in production or have an approved plan for development and operations.

As of 31 December 2000, there were 62 fields on the Norwegian continental shelf with approved plans for development and operation, including the ten fields that have ceased production. Troll is considered to be one field, in spite of the fact that it consists of separate developments with different operators. In 2000, plans for development and operation of the Grane, Kvitebjørn, Ringhorne, Glitne and Tambar fields were approved.

Two new fields started production in 2000: Oseberg Sør and Sygna, both in the North Sea. Of 52 fields in Resource Classes 1 and 2, 45 were producing at the end of the year. Seven fields have been approved for development, but have not yet started production (Table 1.3.3).

Total recoverable reserves in fields approved for development are 6071 million Sm^3 oil equivalents, divided among 3751 million Sm^3 oil, 1937 billion Sm^3 gas, 142 million Sm^3 condensate and 127 million tonnes NGL (Table 1.3.1). Resources totaling 1279 million Sm^3 oil equivalents have been registered as additional resources in fields. These are divided among 262 million Sm^3 oil, 937 billion Sm^3 gas, 10 million Sm^3 condensate and 36 million tonnes NGL.

A total of 3005 million Sm^3 oil equivalents has been sold, divided between 2187 million Sm^3 oil, 52 million tonnes NGL, 41 million Sm^3 condensate and 677 million Sm^3 gas.

The ratios between original saleable volume and remaining petroleum in fields in production or fields with approved plans for development and operation are shown in Table 1.3.4. Some fields have experienced changes in the reserves estimates since last year's reporting. Explanations are provided below for those fields that have experienced a change of ten per cent compared with last year, or a change of more than 10 million Sm^3 oil equivalents since last year's annual report.

The oil and gas reserves on Ekofisk have been adjusted upwards by 13 per cent. This is mainly due to extended lifetime and a new reservoir model.

On Njord, the total oil reserves have been adjusted downwards by about 30 per cent, or 6 million Sm^3 oil

Table 1.3.3 Reserves in fields which are in production or have an approved plan for development and operations

Field	Reserves Million Sm^3 o.e.	Discovery year [1]	Operator	Production license/ Unit Area
Balder	29,5	1967	Esso Exploration and Production Norway A/S	1
Borg	14,5	1992	Norsk Hydro Produksjon AS	89
Brage	52,5	1980	Norsk Hydro Produksjon AS	Brage
Draugen	119,2	1984	A/S Norske Shell	93
Ekofisk	662,5	1969	Phillips Petroleum Company Norway	18
Eldfisk	167,7	1970	Phillips Petroleum Company Norway	18
Embla	21,2	1988	Phillips Petroleum Company Norway	18
Frigg	120,5	1971	TotalFinaElf Exploration Norge AS	Frigg
Frøy	7,4	1987	TotalFinaElf Exploration Norge AS	Frøy
Glitne	4,0	1995	Den norske stats oljeselskap a.s	048 B
Grane	120,0	1991	Norsk Hydro Produksjon AS	Grane
Gullfaks	345,8	1978	Den norske stats oljeselskap a.s	50
Gullfaks Sør	101,2	1978	Den norske stats oljeselskap a.s	50
Gungne	13,1	1982	Den norske stats oljeselskap a.s	46
Gyda	38,1	1980	BP Amoco Norge AS	019 B
Gyda Sør	9,1	1991	BP Amoco Norge AS	019 B
Heidrun	204,2	1985	Den norske stats oljeselskap a.s	Heidrun
Heimdal	48,7	1972	Norsk Hydro Produksjon AS	Heimdal
Hod	9,7	1974	BP Amoco Norge AS	33
Huldra	27,1	1982	Den norske stats oljeselskap a.s	Huldra
Jotun	32,3	1994	Esso Exploration and Production Norway A/S	Jotun
Kvitebjørn	76,7	1994	Den norske stats oljeselskap a.s	193
Loke	2,1	1983	Den norske stats oljeselskap a.s	Sleipner Øst
Murchison	14,7	1975	Kerr Mc-Gee North Sea (UK) Ltd	Murchison
Njord	22,0	1986	Norsk Hydro Produksjon AS	Njord
Norne	102,5	1992	Den norske stats oljeselskap a.s	Norne
Oseberg	379,8	1979	Norsk Hydro Produksjon AS	Oseberg
Oseberg Sør	61,7	1984	Norsk Hydro Produksjon AS	Oseberg Sør
Oseberg Vest	8,0	1984	Norsk Hydro Produksjon AS	Oseberg
Oseberg Øst	25,2	1981	Norsk Hydro Produksjon AS	53
Ringhorne	41,4	1997	Esso Exploration and Production Norway A/S	27
Sleipner Vest	150,3	1974	Den norske stats oljeselskap a.s	Sleipner Vest
Sleipner Øst	97,9	1981	Den norske stats oljeselskap a.s	Sleipner Øst
Snorre	247,1	1979	Norsk Hydro Produksjon AS	Snorre
Statfjord	650,3	1974	Den norske stats oljeselskap a.s	Statfjord
Statfjord Nord	49,4	1977	Den norske stats oljeselskap a.s	37
Statfjord Øst	42,7	1976	Den norske stats oljeselskap a.s	Statfjord Øst
Sygna	11,0	1996	Den norske stats oljeselskap a.s	Sygna
Tambar	8,9	1983	BP Amoco Norge AS	65
Tor	40,3	1970	Phillips Petroleum Company Norway	Tor
Tordis	38,3	1987	Norsk Hydro Produksjon AS	89
Tordis Øst	5,8	1993	Norsk Hydro Produksjon AS	89
Troll [2]	897,7	1979	Norsk Hydro Produksjon AS	Troll
Troll [3]		1979	Den norske stats oljeselskap a.s	Troll
Tune	30,2	1996	Norsk Hydro Produksjon AS	190
Ula	84,9	1976	BP Amoco Norge AS	19
Valhall	181,3	1975	BP Amoco Norge AS	Valhall
Varg	4,9	1984	Norsk Hydro Produksjon AS	38
Veslefrikk	60,8	1981	Den norske stats oljeselskap a.s	52
Vigdis	31,9	1986	Norsk Hydro Produksjon AS	89
Visund	37,1	1986	Norsk Hydro Produksjon AS	Visund
Yme	8,1	1987	Den norske stats oljeselskap a.s	114
Åsgard	356,1	1981	Den norske stats oljeselskap a.s	Åsgard

1) Discovery year is defined as the year of the oldest discovery well included in the field.
2) The resources include the total resources in Troll, also the part operated by Den norske stats oljeselskap a.s.
3) The resources are included in the above row.

equivalents. The decrease is based on a decline of the original resources in place (STOOIP) and analysis of production behavior.

On Sleipner Vest, the recoverable gas reserves have been changed due to a downward adjustment of the original resources in place and a new, historically adapted reservoir simulation model.

On Sleipner Øst, the saleable gas reserves have been adjusted upwards by 15 billion Sm^3 due to a new reservoir model.

On Troll, the estimated oil reserves have been increased after a plan for development and operation comprising four extra wells was approved. The production license has also resolved to drill a number of new wells.

Table 1.3.4 Original and remaining reserves in fields in production or in fields with an approved plan for development and operation

	Original recoverable					Remaining				
	Oil	Gas	NGL	Cond.	Total o.e.	Oil	Gas	NGL	Cond.	Total o.e.
	Million Sm³	Billion Sm³	tonnes	Million Sm³	Million Sm³	Million Sm³	Billion Sm³	tonnes	Million Sm³	Million Sm³
Balder	29,5				29,5	24,5				24,5
Borg[5]	12,6	1,1	0,4		14,5					
Brage [6]	48,1	2,9	0,8		52,5	11,2	1,3		-0,1	12,9
Draugen	114,2	1,7	1,7		119,2	49,2	1,7	1,7		54,2
Ekofisk	456,3	180,3	13,7		662,5	177,9	65,0	3,6		249,8
Eldfisk	111,5	48,1	4,3		167,7	44,4	16,4	1,1		63,0
Embla	13,3	6,8	0,6		21,2	6,3	4,4	0,4		11,5
Frigg		120,1		0,5	120,5	0,0	6,9			6,9
Frøy	5,6	1,7		0,1	7,4	0,1	0,1			0,2
Glitne[1]	4,0				4,0	4,0				4,0
Grane[1]	120,0				120,0	120,0				120,0
Gullfaks[6]	320,6	21,3	2,1		345,8	45,2	2,7	0,7	-0,7	48,5
Gullfaks Sør	44,2	47,5	5,0		101,2	38,9	47,0	5,0		95,3
Gungne[2]		8,3	1,0	3,0	13,1					
Gyda	31,1	4,2	1,5		38,1	6,5	2,6	0,5		10,0
Gyda Sør[3]	4,6	3,4	0,6		9,1					
Heidrun	183,8	20,2	0,1		204,2	122,3	18,0	0,1		140,5
Heimdal[6]	6,9	41,8			48,7	0,8	-0,7			0,1
Hod	7,9	1,4	0,2		9,7	1,4	0,2			1,6
Huldra[1]		19,1	0,3	7,4	27,1	0,0	19,1	0,3	7,4	27,1
Jotun	31,1	1,2			32,3	23,1	0,9			23,9
Kvitebjørn[1]		56,5	0,5	19,3	76,7	0,0	56,5	0,5	19,3	76,7
Loke[2]		1,1	0,2	0,6	2,1					
Murchison	13,6	0,4	0,4		14,7	0,7	0,1			0,8
Njord	22,0				22,0	12,5				12,5
Norne	84,8	15,0	1,4		102,5	59,4	15,0	1,4		77,0
Oseberg[6]	337,0	35,4		7,4	379,8	58,1	40,0	-0,2	7,3	105,0
Oseberg Sør	54,4	7,3			61,7	53,0	7,3			60,2
Oseberg Vest[4]	2,0	6,0			8,0					
Oseberg Øst	23,8	1,4			25,2	20,3	1,4			21,7
Ringhorne[1]	39,2	2,2			41,4	39,2	2,2			41,4
Sleipner Vest[2]		108,4	7,3	28,1	150,3					
Sleipner Øst[2]		53,0	10,9	24,2	97,9		113,5	8,7	20,3	150,4
Snorre[6]	225,3	8,9	6,8		247,1	145,3	5,4	4,5	-0,5	158,7
Statfjord[6]	566,9	56,1	14,4		650,3	59,0	12,7	4,5	-3,1	77,1
Statfjord Nord[6]	45,7	2,3	0,8		49,4	25,5	1,2	0,5	-0,1	27,6
Statfjord Øst[6]	34,5	6,1	1,1		42,7	12,3	4,5	0,6	-0,1	18,0
Sygna	10,3	0,7			11,0	9,7	0,7			10,4
Tambar[1]	6,5	1,8	0,3		8,9	6,5	1,8	0,3		8,9
Tor	26,4	11,5	1,2		40,3	5,3	1,0	0,1		6,4
Tordis[6]	34,2	2,5	0,9		38,3	25,3	1,9	0,8	-0,1	28,6
Tordis Øst[5]	5,2	0,4	0,1		5,8					
Troll	213,4	665,1	10,1		897,7	136,8	575,2	10,1		731,1
Tune[1]		24,0	0,1	6,1	30,2	0,0	24,0	0,1	6,1	30,2
Ula	76,3	3,7	2,6		84,9	15,3	0,0	0,2	0,0	15,8
Valhall	149,3	24,8	3,8		181,3	83,0	11,5	1,6		97,6
Varg	4,9				4,9	1,4				1,4
Veslefrikk[6]	54,5	4,2	1,2		60,8	16,2	2,2	0,1	-0,1	18,6
Vigdis	29,8	2,1			31,9	14,2	2,1			16,3
Visund	37,1				37,1	34,2				34,2
Yme	8,1				8,1	0,4				0,4
Åsgard	68,5	190,7	27,6	44,5	356,1	56,8	190,2	27,6	44,5	343,9
Total	**3719,0**	**1822,2**	**123,6**	**141,0**	**5917,3**	**1565,9**	**1255,9**	**75,1**	**100,0**	**3064,6**

1) Fields with an approved development plan where production had not started as of 31 December 2000.
2) Gas production from the Sleipner area is metered in total. All production in this area is deducted from the reserves in Sleipner Øst.
3) Production from Gyda and Gyda Sør is metered in total. All production is deducted from the reserves in Gyda.
4) Production from Oseberg Vest and Oseberg is metered in total. All production is deducted from the reserves in Oseberg.
5) Production from Borg, Tordis Øst and Tordis is metered in total. All production is deducted from the reserves in Tordis.
6) Small negative figures for remaining resources are due to technical accounting factors, and are due to a mismatch between the approximate recoverable resources and exact production figures.

Table 1.3.5 Resources in discoveries in the late planning stages (Resouce Class 3)

	Oil	Gas	NGL	Condensate	Oil-equivalents [1]	Discovery year [2]
	Million Sm³	Billion Sm³	Million tonnes	Million Sm³	Million Sm³	
16/7-4 Sigyn	0,0	5,6	2,6	5,6	16,1	1982
2/12-1 Freja	2,0	0,3	0,1	0,0	2,5	1987
25/4-6 S Vale	0,0	2,4	0,0	3,1	5,4	1991
30/6-17	0,3	1,7	0,0	0,0	2,0	1986
30/6-18 Kappa	1,0	2,7	0,0	0,0	3,7	1986
30/9-19	2,3	6,8	0,0	0,0	9,1	1998
34/7-23 S	4,3	0,5	0,0	0,0	4,8	1994
35/11-4 Fram	30,8	11,3	0,6	0,0	43,2	1991
6406/2-3 Kristin	0,0	35,4	8,5	40,4	92,0	1997
6407/1-2 Tyrihans Sør	0,0	24,5	4,6	15,5	48,7	1983
6407/6-3 Mikkel [3]	1,0	20,4	6,3	4,1	37,4	1986
7121/4-1 Snøhvit	11,4	167,2	5,8	19,7	209,3	1984
6608/10-6 Svale [3]	18,5	0,0	0,0	0,0	18,5	2000
6507/5-1 Skarv	20,9	69,1	0,0	10,1	100,1	1998
Total	**92,4**	**347,8**	**28,5**	**98,4**	**592,7**	

1) The conversion factor for NGL in tonnes to Sm³ is 1.9
2) Discovery year is defined as the year of the oldest discovery well included in the field
3) The discovery also contains deposits with resources in higher resource classes

Table 1.3.6 Resources in discoveries in the early planning stages (Resource Class 4)

	Oil	Gas	NGL	Condensate	Oil-equivalents [1]	Discovery year [2]
	Million Sm³	Billion Sm³	Million tonnes	Million Sm³	Million Sm³	
15/5-1 Dagny		5,8	1,0	1,0	8,7	1978
2/4-17 Tjalve	1,0	1,6	0,1		2,8	1992
25/5-3 Skirne		4,3		0,9	5,2	1990
25/5-4 Byggve		2,4		0,7	3,0	1991
25/5-5	4,3				4,3	1995
3/7-4 Trym		3,3		0,8	4,1	1990
6305/5-1 Ormen Lange		400,0		23,7	423,7	1997
15/9-19 S Volve	4,6	0,5	0,2		5,4	1993
25/11-16	3,6				3,6	1992
35/8-1		20,8	3,1	3,7	30,3	1981
35/9-1 Gjøa	7,6	19,9	1,0	0,0	29,5	1989
6406/2-1 Lavrans [3]		28,3	4,4	7,6	44,2	1995
Total	**21,1**	**486,8**	**9,7**	**38,4**	**564,7**	

1) The conversion factor for NGL in tonnes to Sm³ is 1.9
2) Discovery year is defined as the year of the oldest discovery well included in the field
3) The discovery also contains deposits with resources in higher resource classes

Table 1.3.8 Resources in discoveries where evaluation is not complete (Resource Class 7)

	Oil	Gas	NGL	Condensate	Oil-equivalents	Discovery year [1]
	Million Sm³	Billion Sm³	Million tonnes	Million Sm³	Million Sm³	
6407/7-6	2	0	0	0	2	2000
6506/6-1	0	93	0	0	93	2000
6608/11-2	3	0	0	0	3	2000
7019/1-1	0	2	0	0	2	2000
7122/7-1	15	0	0	0	15	2000
Total	**20**	**95**	**0**	**0**	**115**	

1) Discovery year is defined as the year of the oldest discovery well included in the field

Table 1.3.7 Resources in discoveries which may be developed over the long term (Resource Class 5)

	Oil	Gas	NGL	Condensate	Oil-equivalents [2]	Discovery year [1]
	Million Sm^3	Billion Sm^3	Million tonnes	Million Sm^3	Million Sm^3	
1/2-1 Blane	2,1				2,1	1989
1/5-2 Flyndre	5,1	1,6			6,6	1974
15/3-1 S		3,6		15,5	19,1	1975
15/3-4	11,5	5,8			17,3	1982
15/5-2		3,4	0,2	0,2	4,0	1978
15/8-1 Alpha		4,1	0,5	1,0	6,1	1982
16/7-2		1,8	0,3	0,5	2,9	1982
18/10-1	1,2				1,2	1980
2/2-1	0,4	1,1			1,5	1982
2/2-5	2,4				2,4	1992
2/4-10	2,4	0,0			2,4	1973
2/5-3 Sørøst Tor	0,9	0,3			1,2	1972
2/6-5	0,9				0,9	1996
2/7-19	3,6	3,5			7,1	1990
2/7-22		0,6			0,6	1990
2/7-29	1,5	0,6			2,1	1994
24/12-3 S	0,2				0,2	1996
24/6-1 Peik		5,3		1,2	6,5	1985
24/6-2	7,3	3,2			10,5	1998
24/9-3	3,3	0,1			3,4	1981
24/9-5	2,7				2,7	1994
25/7-5	6,0	0,6			6,6	1997
25/8-4	1,0				1,0	1992
30/10-6		5,7			5,7	1992
30/7-6 Hild	13,1	33,4			46,5	1978
34/10-23 Gamma		12,8		1,3	14,1	1985
34/7-18	1,7	0,0			1,7	1991
35/10-2		1,6			1,6	1996
35/3-2 Agat		43,0			43,0	1980
35/9-3	0,3	0,4			0,7	1997
36/7-2	1,1				1,1	1997
6406/2-6 Ragnfrid		6,4		4,3	10,7	1998
6406/2-7 Erlend		6,2		4,2	10,4	1999
6406/3-2 Trestakk	5,3	1,8			7,0	1986
6407/8-2	0,4	1,4			1,8	1994
6506/11-2 Lange	3,5	1,8			5,3	1991
6506/12-3 Lysing	1,2	0,2			1,5	1985
6507/2-2		19,8			19,8	1992
6507/3-1 Alve	6,1	12,4			18,5	1990
6507/3-3	0,6	17,4			18,0	1999
6707/10-1		38,3			38,3	1997
7/7-2	2,4	0,1			2,5	1992
7120/12-2		10,7			10,7	1981
7120/12-3		4,1			4,1	1983
7121/4-2 Snøhvit Nord		3,5		0,2	3,7	1985
7121/5-2 Beta	3,1	3,3			6,4	1986
7122/6-1	2,6	5,4		0,6	8,6	1987
7124/3-1		2,1			2,1	1987
Total	**93,8**	**267,2**	**1,0**	**28,9**	**391,8**	

1) Discovery year is defined as the year of the oldest discovery well included in the field
2) The conversion factor for NGL in tonnes to Sm^3 is 1.9

Table 1.3.9
Discoveries which in 2000 are reported as part of other fields or discoveries

Discovery	Reported in field	Discovery year
15/12-10 S	Varg	1996
15/9-20 S	Sleipner Øst	1994
2/11-10 S	Hod	1994
2/7-8	Eldfisk	1973
25/7-3 Jotun	Jotun	1995
25/8-1 Ringhorne	Ringhorne	1970
25/8-11 Ringhorne	Ringhorne	1997
25/8-8 S Jotun	Jotun	1995
30/3-6 S	Veslefrikk	1994
30/3-7 A	30/3-2 Veslefrikk	1998
30/3-7 B	30/3-2 Veslefrikk	1998
30/3-7 S	30/3-2 Veslefrikk	1995
30/3-9	30/3-2 Veslefrikk	2000
30/6-19 Beta Sadel	Oseberg Sør	1986
30/9-10 Oseberg Sør	Oseberg Sør	1990
30/9-13 S Oseberg Sør	Oseberg Sør	1991
30/9-15 Oseberg Sør	Oseberg Sør	1994
30/9-16 K Oseberg Sør	Oseberg Sør	1994
30/9-4 S Oseberg Sør	Oseberg Sør	1985
30/9-5 S Oseberg Sør	Oseberg Sør	1985
30/9-6 Oseberg Sør	Oseberg Sør	1987
30/9-7 Oseberg Sør	Oseberg Sør	1988
30/9-9 Oseberg Sør	Oseberg Sør	1989
33/9-0 Murchison NØ Horst	Murchison	1989
33/9-6	33/9-8 Statfjord Nord	1976
34/10-17 Rimfaks	Gullfaks Sør	1983
34/10-21	Gullfaks Sør	1984
34/10-34 Gullfaks Vest	Gullfaks	1991
34/10-37 Gullveig	Gullfaks Sør	1995
34/7-13 Vigdis Vest	Vigdis	1988
34/7-16	Vigdis	1990
34/7-25 S	Vigdis	1996
34/8-4 S	Visund	1991
6506/12-1 Smørbukk	Åsgard	1985
6506/12-3 Smørbukk Sør	Åsgard	1985
6507/8-4 Heidrun Nord	Heidrun	1990
6608/10-4	Norne	1994
9/2-3	Yme	1990
9/2-6 S	Yme	1996
9/2-7 S	Yme	1997
9/2-9 S	Yme	1999
Discovery	**Reported in discovery**	**Discovery year**
16/7-7 S	16/7-4 Sigyn	1997
2/7-31	08.02.23	1999
24/9-6	24/9-5	1994
30/7-2	30/7-6 Hild	1975
34/7-29 SR	34/7-23S	1998
35/11-2	35/11-4 Fram	1987
35/11-7	35/11-4 Fram	1992
35/11-8 S	35/11-4 Fram	1996
35/8-2	35/8-1	1982
36/7-1	35/9-1 Gjøa	1996
6407/1-3 Tyrihans Nord	6407-1 Tyrihans Sør	1984
6507/5-3	6507/5-1 Skarv	2000
7120/7-1 Askeladd Vest	7121-4 Snøhvit	1982
7120/7-2 Askeladd Sentral	7121-4 Snøhvit	1983
7120/8-1 Askeladd	7121-4 Snøhvit	1981
7120/9-1 Albatross	7121-4 Snøhvit	1982
7121/7-1	7121-4 Snøhvit	1984
7121/7-2 Albatross Sør	7121-4 Snøhvit	1986

On Tordis the oil reserves have increased because the 34/7-25 S STUJ discovery is included in the reserves.

On Valhall, the plan for development and operation of the Valhall water injection project has been approved, and this has increased oil reserves by about 20 per cent.

On Visund, reserves have been reduced due to new reservoir information. Some of the oil resources have also been reclassified and moved to Resource Class 3, late planning stage.

Resources in discoveries in the late planning stages, Resource Class 3

At the end of 2000/beginning of 2001, there were 14 discoveries in the late planning stages (Table 1.3.5). These are discoveries which have submitted plans for development and operation for consideration by the authorities or discoveries where the operator has indicated that a plan for development and operation will be submitted and where it is assumed that a plan will be approved by the authorities within two years. The petroleum resources in these discoveries constitute a total of 593 million Sm^3 oil equivalents.

Several projects in Resource Class 3 have changed status since last year's annual report. The 25/11-15 Grane, 25/8-10 Ringhorne, 34/11-1 Kvitebjørn, 15/5-5 Glitne and 1/3-3 Tambar discoveries have all received approval of plans for development and operation during 2000, and have thus gained field status. The total recoverable reserves in all of these fields have increased due to improved reservoir knowledge.

The operators consider the 25/11-16, 35/8-1, 35/9-1 Gjøa and 6406/2-1 Lavrans discoveries to be less likely development projects, and these resources have now been moved to Resource Class 4.

6507/5-1 Skarv has been moved from Resource Class 4 to Resource Class 3. BP's gas discovery in 2000, 6507/5-3 Snadd, is reported under 6507/5-1 Skarv. The resource estimate has been increased by about 50 million Sm^3 oil equivalents.

The 6608/10-6 Svale discovery was made in 2000. The resource estimate is preliminary, and therefore uncertain. The reason that the discovery has already been classified in Resource Class 3 is that one has seen a possibility of developing this in connection with Norne.

The resource estimate for 16/7-4 Sigyn has been adjusted upwards as a consequence of improved reservoir understanding.

The resource estimate for 35/11-4 Fram has been reduced as a result of a new and changed development concept. This will be considered in connection with the plan for development and operation for 35/11-4 Fram Vest.

Resources in discoveries in the early planning stages, Resource Class 4

As of the end of the year, there were 12 discoveries in the early planning stages (Table 1.3.6). This means discoveries where it is assumed that a plan for development and operation will be approved during the course of 2-10 years. The resource volume amounts to 565 million Sm^3 oil equivalents.

The resources in the 6305/7-1 Ormen Lange discovery have been adjusted upwards by 25 per cent. The operators now consider the 25/11-16, 35/8-1, 35/9-1 Gjøa and 6406/2-1 Lavrans discoveries to be less likely development projects, and these resources have since 1999 been moved from Resource Class 3 to Resource Class 4.

The 15/9-9 S Volve discovery has matured and been moved from Resource Class 5.

Resources in discoveries which may be developed over the long term, Resource Class 5

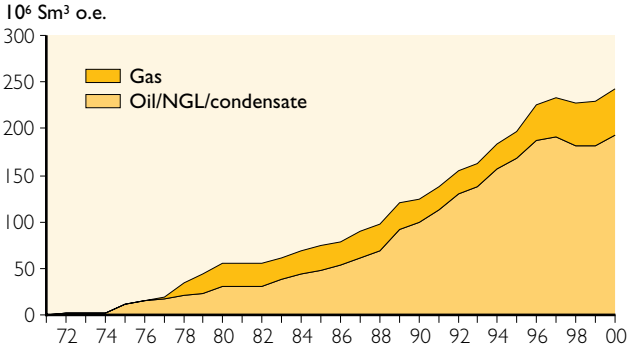
As of the end of the year, 48 discoveries (Table 1.3.7) have been identified which the Norwegian Petroleum Directorate believes may be developed over the long term, even though many of the discoveries are currently not considered to be profitable by the licensees. This class also includes discoveries in relinquished areas, which the Norwegian Petroleum Directorate nevertheless assumes will be re-awarded and may be developed over the long term. The registered resources amount to 392 million Sm^3 oil equivalents.

The resources in 6507/2-2 have been adjusted upwards after re-mapping and field studies by the new operator (Norsk Agip). The resources in 6507/3-1 Alve have been adjusted upwards in accordance with a new field model.

Resources in discoveries where development is not very likely, Resource Class 6

As of the end of the year, 34 discoveries have been registered for which profitable development is not expected without significant changes in technology or price. Most of these discoveries are very small. Some have such poor reservoir properties that they cannot be produced profitably with today's technology and oil price. There is great uncertainty with regard to the resource estimates. However, the Norwegian Petroleum Directorate estimates that the resources amount to about 108 million Sm^3 oil equivalents.

Figure 1.4.1.
Oil and gas production on the Norwegian continental shelf 1971-2000



Resources in discoveries where evaluation is not complete, Resource Class 7

As of the end of the year, five discoveries have been registered in this resource class. The preliminary estimates for discoveries in Resource Class 7 amount to about 115 million Sm^3 oil equivalents (Table 1.3.8). The estimates are associated with great uncertainty.

1.4 PRODUCTION OF OIL AND GAS

The production of oil and gas on the Norwegian shelf amounted to 243.6 million Sm^3 oil equivalents in 2000. Production in 1999 amounted to 226.8 million Sm^3 oil equivalents.

Production details are presented in Table 1.4.1 and in Figure 1.4.1. Table 1.4.1 shows the Norwegian share of production for Statfjord, Frigg and Murchison.

1.5 PETROLEUM ECONOMY

1.5.1 SALE OF PETROLEUM FROM THE NORWEGIAN CONTINENTAL SHELF

In 2000, 153.7 million tonnes of crude oil were sold from the Norwegian continental shelf. This represents an increase of 7.8 per cent compared with 1999. The United Kingdom was the largest receiver, accounting for 22.3 per cent of the shipments. Norway received 15.7 per cent, the Netherlands 15.2 per cent, France 12.7 per cent and Sweden 6.2 per cent. In 1999, Norway received 17.1 per cent. Figure 1.5.1 shows crude oil sales distributed by country in the period 1992-2000.

Sale of NGL (including condensate) from the Norwegian shelf in 2000 reached 7.2 million tonnes. This is 0.5 million tonnes less than in 1999.

Norway exported 48.6 billion Sm^3 gas in 2000. This is an increase of 6.8 per cent compared with 1999. 18.7 billion Sm^3 was sold to Germany, 2.2 billion Sm^3 to the United Kingdom, 12.0 billion Sm^3 to France, 5.1 billion Sm^3 to the Netherlands, 5.5 billion Sm^3 to Belgium, 2.5 billion Sm^3 to Spain, 1.9 billion Sm^3 to Czechia and 0.7 billion Sm^3 to Austria, see Figure 1.5.2.

1.5.2 PRODUCTION ROYALTY

The Norwegian Petroleum Directorate has been delegated the responsibility for collection of royalties from petroleum production. Production royalty is calculated according to the provisions of the Petroleum Act and the Petroleum Regulations. The basis for calculation of the royalty is the value of the produced petroleum at each production area's loading point. As it is not customary to calculate the price of petroleum products at the loading point, in practice the calculation basis applied is the difference between the gross sales value and the costs incurred between the taxation point and the point of sale. No production royalty shall be paid on production from

deposits where the plan for development and operations is approved or requirements for a plan for development and operation terminate after 1 January 1986, cf. Section 4-9 of the Petroleum Act.

From 1 January 1992, the royalty rate for gas was set at nil, cf. Section 31 of the Petroleum Regulations. This means that, as of that date, royalty is only to be levied on oil.

In connection with the start-up of the new process facility on Ekofisk (Ekofisk II) on 7 August 1998, the Ministry granted an exemption for production royalty on oil and NGL produced from Production License 018.

In Proposition No. 1 (1999-2000) to the Storting, the Government proposed a gradual reduction of the production royalty starting 1 January 2000. As early as 1 January 2000, production royalty was discontinued on the Heimdal, Tor and Murchison fields. Production royalty will be gradually reduced over three years for the fields Statfjord, Ula and Valhall and over six years for the fields Oseberg and Gullfaks.

Since, on some fields, oil and NGL are a single product at the loading point and the NGL is separated at a later stage, royalty will be paid on the NGL for these fields. On the other hand, royalty will not be levied on NGL in those fields where NGL is part of the gas at the loading point.

Table 1.4.1
Production in million Sm^3 oil equivalents

	PRODUCTION ---------->			CONSUMPTION -------->		SALEABLE PRODUCTS ---------->			
				Gas	Gas				
2000	Oil	Gas	Condensate	Flare	Fuel	Oil	Gas	NGL/ Condensate	Total
Balder	4,018	0,211		0,129	0,001	4,018			4,018
Borg	0,927	0,114							0,000
Brage	2,647	0,281		0,006	0,061	2,633	0,150	0,113	2,896
Draugen	11,744	0,672		0,008	0,053	11,744	0,021	0,036	11,801
Ekofisk	16,702	3,326		0,023	0,316	16,669	3,014	0,548	20,231
Eldfisk	1,223	0,847		0,002	0,057	1,272	0,664	0,117	2,053
Embla	0,630	0,324				0,638	0,225	0,061	0,924
Frigg		0,609	0,001	0,003	0,016		0,602		0,602
Frøy	0,301	0,371				0,263	0,358	0,015	0,636
Gullfaks incl. Gullfaks Vest	13,272	3,129		0,072	0,344	13,272	0,935	0,156	14,363
Gullfaks Sør incl. Rimfaks and Gullveig	2,994	1,377				2,994	0,530	0,101	3,625
Gungne		0,493						0,325	0,325
Gyda incl. Gyda Sør	1,110	0,318		0,001	0,031	1,115	0,281	0,124	1,520
Heidrun	10,590	2,053		0,009	0,112	10,620	0,608		11,228
Hod	0,072	0,010				0,094	0,011	0,003	0,108
Jotun	7,165	0,363		0,019	0,030	7,166	0,317		7,483
Lille-Frigg						0,001			0,001
Murchison	0,170	0,019		0,001	0,005	0,168	0,005		0,173
Njord	3,923	2,785		0,009	0,070	3,921			3,921
Norne	10,420	2,284		0,008	0,141	10,420			10,420
Oseberg	16,173	10,847		0,025	0,365	15,411	1,362	0,630	17,403
Oseberg Sør	1,437	0,303		0,011	0,015	1,432			1,432
Oseberg Øst	2,555	0,244		0,007	0,028	2,554			2,554
Oseberg Vest									0,000
Sleipner Vest		7,654	3,472	0,007	0,079			3,749	3,749
Sleipner Øst incl. Loke and saleable gas from Sleip. Vest		7,111	4,310	0,004	0,192		11,896	4,364	16,260
Snorre	8,602	1,445		0,029	0,103	8,587	0,285	0,540	9,412
Statfjord	10,892	5,908		0,116	0,394	10,886	1,559	0,703	13,148
Statfjord Nord	3,991	0,317				3,998	0,122	0,079	4,199
Statfjord Øst	2,818	0,399				2,822	0,345	0,225	3,392
Sygna	0,642	0,040				0,642			0,642
Tor	0,256	0,049		0,001	0,007	0,255	0,040	0,011	0,306
Tordis incl. Tordis Øst	3,223	0,331				3,994	0,233	0,163	4,390
Troll area	18,419	26,699	0,650	0,020	0,195	18,361	24,666		43,027
Ula	1,163	0,134		0,002	0,047	1,178		0,043	1,221
Valhall	4,030	0,991		0,009	0,083	4,578	0,890	0,221	5,689
Varg	1,737	0,350		0,014	0,012	1,737			1,737
Veslefrikk	2,402	0,757		0,018	0,048	2,404	0,200	0,140	2,744
Vigdis	4,198	0,293				4,198			4,198
Visund	2,253	1,009		0,014	0,072	2,253			2,253
Yme	1,139	0,051		0,012	0,017	1,071			1,071
Åsgard	7,837	5,728		0,102	0,127	7,837	0,533	0,179	8,549
Total 2000	181,675	90,246	8,433	0,681	3,021	181,206	49,852	12,646	243,704
Total 1999	170,693	80,255	9,812	0,660	2,647	168,598	48,257	13,300	230,155
Total 1998	170,039	72,594	9,433	0,441	2,890	168,950	44,190	13,400	226,540
Total 1997	178,388	70,365	10,133	0,411	3,034	175,868	42,949	14,500	233,317
Total 1996	177,282	59,456	8,400	0,448	2,833	175,496	37,407	12,700	225,603
Total 1995	157,926	47,190	6,971	0,409	2,640	156,622	27,814	11,600	196,036
Total 1994	147,674	45,393	5,300	0,364	2,630	146,282	26,842	9,900	183,024
Total 1993	133,770	41,576	1,464	0,340	2,544	131,843	24,804	6,000	162,647
Total 1992	125,936	42,444	0,615	0,309	2,449	123,999	25,834	5,000	154,833
Total 1991	110,513	39,717	0,603	0,356	2,257	108,510	25,027	4,900	138,437
Total 1990	96,844	37,065	0,560	0,556	2,132	94,542	25,479	5,000	125,021
Total 1989	88,266	39,320	0,587	0,474	2,013	85,983	28,738	4,900	119,621
Total 1988	66,882	36,302	0,631	0,336	1,818	64,723	28,330	4,900	97,953
Total 1987	58,538	34,499	0,614	0,434	1,443	56,959	28,151	4,200	89,310
Total 1986	50,579	33,924	0,376	0,258	1,311	48,771	26,090	3,900	78,761

Figure 1.5.1
Sale of crude oil per country 1992-2000

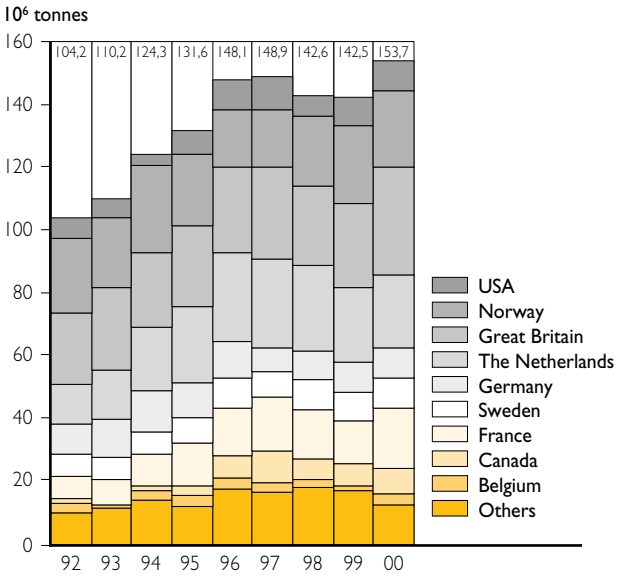
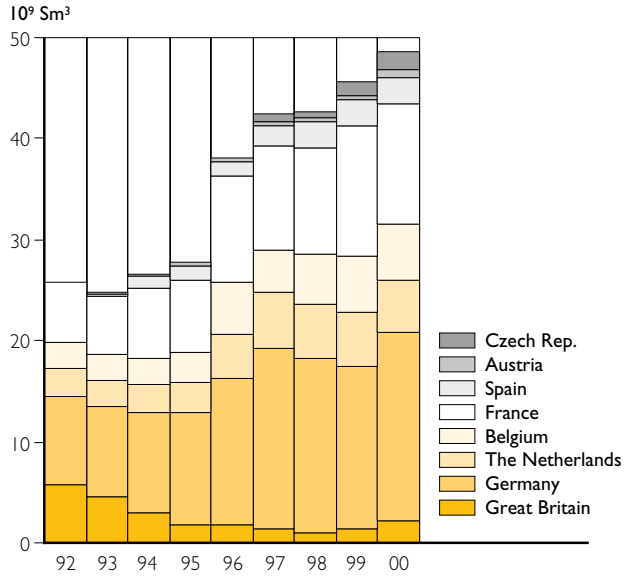


Figure 1.5.2
Sale of gas per country 1992-2000



Total royalty

In 2000, licensees on the Norwegian shelf paid royalties totaling NOK 3,463,467,687 to the Norwegian Petroleum Directorate. Table 1.5.1 shows the breakdown for the various petroleum products for 1999 and 2000. Figure 1.5.3 shows paid production royalty for the period 1991-2000. In Figure 1.5.4, the breakdown of paid production royalty in 1999 and 2000 is shown per field.

Production royalty on oil

In 2000, NOK 3,464,771,310 was paid in royalties for oil from the Ekofisk area (the Tor field), and the Ula, Valhall, Statfjord, Murchison, Oseberg and Gullfaks fields. The production royalty for oil is normally taken out in oil. Sale

Table 1.5.1
Total royalty paid in 1999 and 2000 (million NOK)

Product	Field/area	1999	2000
Oil	Ekofisk area, Ula and Valhall	563.9	122.6
"	Statfjord	1312.1	1604.8
"	Murchison	0.8	19.6
"	Heimdal	0.7	0.0
"	Oseberg	817.7	1077.9
"	Gullfaks	518.9	639.9
Total oil		**3 214,1**	**3 464,8**
NGL	Ekofisk area	3.7	-5.7
"	Valhall	3.6	1.5
"	Ula	0.1	2.0
"	Murchison	0.4	0.9
Total NGL		**7.8**	**-1.3**
Total		**3 221,9**	**3 463,5**

of the State's royalty oil is the responsibility of Statoil. Payment from Statoil to the Norwegian Petroleum Directorate is on a monthly basis. Settlement is at the norm price stipulated by the Petroleum Price Council. The received quantity of royalty oil was reduced by fully 44 per cent in 2000. The reduction is the result of three factors. Firstly, there was a general decline in production in 2000 in those fields which still pay a production royalty. Secondly, the reduction is linked with the tax relief that was implemented for all fields from 1 January 2000. Lower production has also resulted in a reduced royalty rate on some fields. However, the significant decline in received royalty oil has been more than offset by higher oil prices in 2000 compared with 1999. In 2000, the royalty oil was settled at an average price of approximately NOK 239 per barrel, compared with approximately NOK 130 per barrel in 1999. The paid production royalty for oil has thus increased by nearly eight per cent compared with the previous year.

Figure 1.5.3
Royalties paid 1991-2000

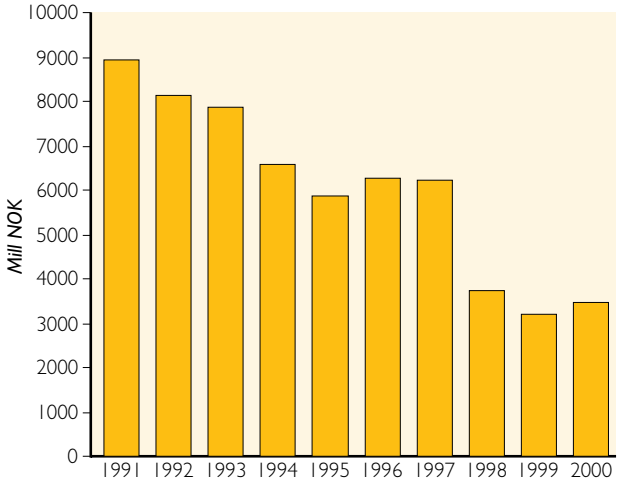
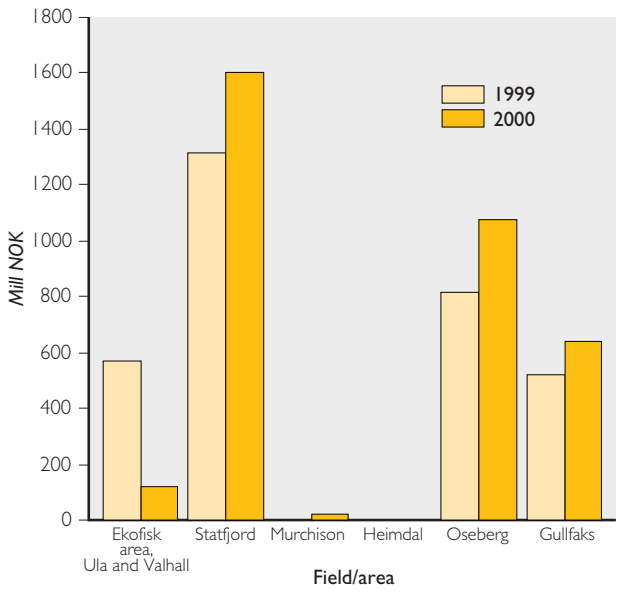


Table 1.5.2 Area fees by award year

Area fees	
Award year	**NOK**
1965	65 156 538
1969	34 960 200
1971	3 912 301
1977	2 831 400
1981	2 772 000
1984	7 854 000
1985	5 906 294
1987	- 3 374 729
1988	5 742 643
1989	4 302 986
1991	15 862 481
1993	15 939 679
1998	6 395 400
Total	**168 261 193**

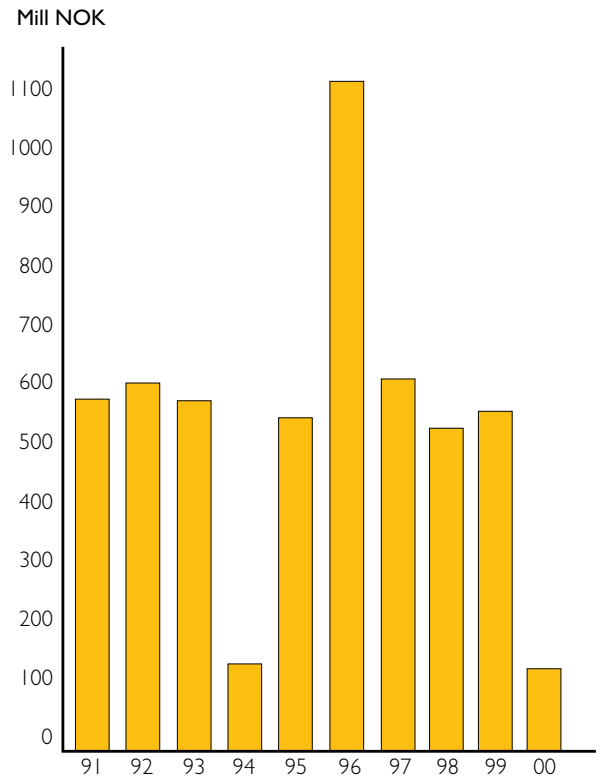
Figure 1.5.4
Royalties paid 1999-2000



Production royalty on NGL

In 2000, a net payment of NOK 1 303 623 was made in relation to production royalty for NGL. This is linked to a rebate of NOK 5 714 384 to the Phillips Group because too much royalty had been paid in previous years for the Ekofisk area.

Figure 1.5.5
Net area fee paid 1991-2000



Settlement of royalties paid in cash is on a six-month basis, with a three-month term for payment. The settlement for NGL has been made at contract prices which vary for the individual fields/groups.

In 1999, NOK 7,751,440 was paid in royalties for NGL. After the production royalty was repealed for the Heimdal, Tor, Valhall and Murchison fields as of 1 January 2000, production royalty on NGL is only collected from one field, Ula.

1.5.3 AREA FEES ON PRODUCTION LICENSES

In 2000, the Norwegian Petroleum Directorate collected NOK 168,261,193 in gross area fees, prior to rebates. The amount is broken down for the various award years as shown in Table 1.5.2.

The Norwegian Petroleum Directorate has refunded NOK 45,842,674 in area fees in 2000. This represents the deductible portion of the area fee in the royalty settlement for production licenses 006, 019A, 019B, 033, 037, 050, 053 and 079.

Figure 1.5.5 shows the net area fee receipts for 1991 - 2000. There is a reduction of more than NOK 400 million in 2000 as compared with 1999. The reason for this is that, in accordance with the 1972 resolution and the Petroleum Act, production licenses could delay the payment date to 2 January 2001 due to the holiday. The production royalty and area fee for 2000 amounted to six per cent of total paid taxes and fees from the petroleum activities. The proportion of the fees has varied over time. The highest

Table 1.5.3 CO_2 tax paid in 2000 (NOK)

Field	1st half	2st half	Total 2000
Balder	19 443 231	45 783 097	65 226 328
Brage	32 400 450	23 177 000	55 577 450
Draugen	29 857 569	20 528 893	50 386 462
Ekofisk area	155 967 092	138 290 373	294 257 465
Frigg area	11 235 024	8 092 738	19 327 762
Gullfaks A/B/C	174 484 765	153 995 855	328 480 620
Gyda	16 067 902	11 386 311	27 454 213
Heidrun	59 724 905	42 762 949	102 487 854
Heimdal	10 607 020	1 099 700	11 706 720
Hod	306 854	76 370	383 224
Jotun	32 309 343	25 544 394	57 853 737
Murchison	5 936 938	8 013 749	13 950 687
Njord A	33 580 590	28 980 000	62 560 590
Norne	61 198 800	52 480 305	113 679 105
Oseberg A/B/C/D	154 726 500	136 322 200	291 048 700
Oseberg Øst	15 987 960	11 270 000	27 257 960
Sleipner	129 263 882	101 966 270	231 230 152
Snorre	74 299 878	72 290 400	146 590 278
Statfjord A/B/C	231 592 677	189 330 851	420 923 528
Troll A	334 227	194 341	528 568
Troll B	60 262 790	45 550 400	105 813 190
Troll C	19 056 680	31 168 900	50 225 580
Ula	22 663 704	15 524 796	38 188 500
Valhall	46 077 723	35 954 493	82 032 216
Varg	18 194 594	11 330 008	29 524 602
Veslefrikk	49 637 446	26 027 395	75 664 841
Visund	33 409 710	36 800 123	70 209 833
Yme	23 623 282	13 595 087	37 218 369
Åsgard	115 751 573	81 176 421	196 927 994
Transportation systems			
Norpipe	29 116 641	5 815 577	34 932 218
Statpipe	2 776 964	2 132 960	4 909 924
Total	1 650 453 483	1 330 878 859	3 046 558 670

Figure 1.5.6
Total taxes and royalties paid 1991 - 2000

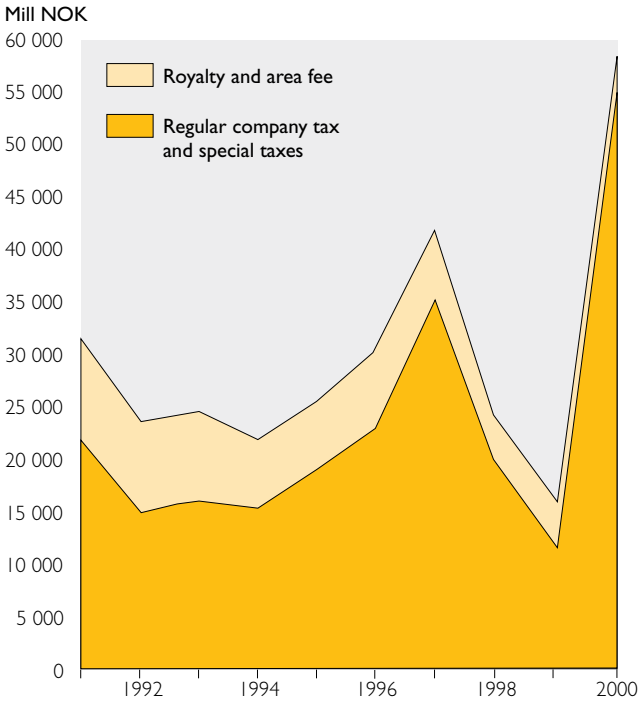
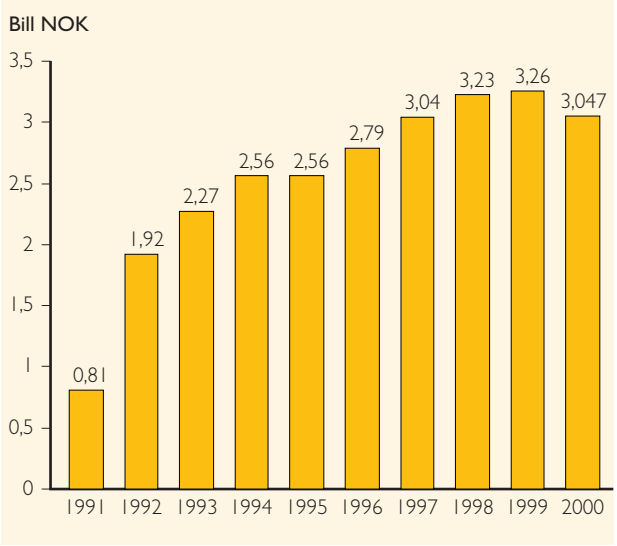


Figure 1.5.7
CO_2 tax paid 1991-2000



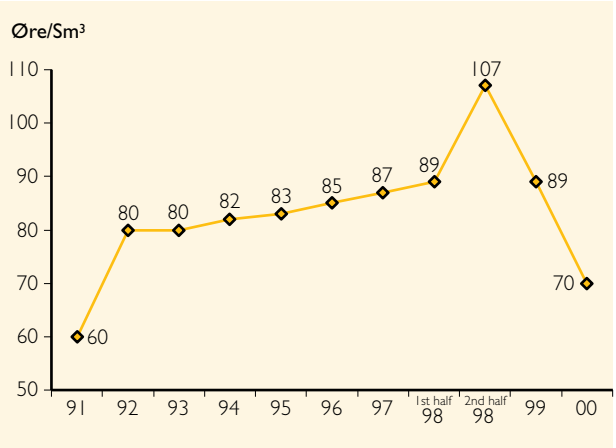
proportion was in 1989 at 53 per cent. Figure 1.5.6 shows total taxes and royalties paid for 1991-2000.

1.5.4 CO_2 TAX

The Act of 21 December 1990 No. 72 relating to tax on emission of CO_2 in the petroleum activities on the continental shelf entered into force on 1 January 1991. The Norwegian Petroleum Directorate has been granted the authority to collect the CO_2 tax and to make administrative decisions necessary to enforce the Act. The tax is calculated on petroleum flared and natural gas or pure CO_2 released to the atmosphere from installations used in connection with production or transportation of petroleum. The CO_2 Act also requires that the companies calculate tax for activities on Norwegian installations for transportation of petroleum which extend beyond the continental shelf. For fields which extend over the median line in relation to another state, the CO_2 tax is only calculated on the Norwegian share.

In the second half of 1999 and the first half of 2000, the CO_2 tax was fixed at NOK 0.89 and 0.70 per Sm^3 gas and NOK 0.89 per liter diesel. The tax is paid on a six-month basis with a three-month term of payment (as of 1 October and 1 April in the following year) by the operator of the individual fields and installations. Table 1.5.3 shows the total tax paid in 2000. The tax is broken down into individual fields and transportation systems. New fields subject to the tax are Balder, Jotun, Oseberg D and Troll C. Corrections relating to previous six-month periods are included. A total of NOK 3 046 558 670 was paid in 2000. Figure 1.5.7 shows the yearly receipts of CO_2 tax for 1991-1999 and Figure 1.5.8 shows changes in the tax rate.

Figure 1.5.8
Tax rate for CO_2 tax (øre/Sm³)



1.6 EXPLORATION LICENSES

1.6.1 LICENSES TO EXPLORE FOR PETROLEUM

As of 31 December 2000, a total of 267 exploration licenses have been awarded. Such licenses are awarded in accordance with the Petroleum Act and have a duration of three years. The following licenses were awarded in 2000:

Company	
TGS-Nopec Geophysical Company ASA	261
Fugro-Geoteam AS	262
Amerada Hess Norge A/S	263
Norsk Hydro Produksjon AS	264
Western Geophysical	265
A/S Norske Shell U&P	266
Norsk Chevron AS	267

1.6.2 LICENSES FOR SCIENTIFIC EXPLORATION

As of 31 December 2000, a total of 349 licenses for scientific exploration have been awarded on the Norwegian continental shelf. Twenty such licenses were awarded in 2000, see Table 1.6.1.

1.7 EXPLORATION ACTIVITY

1.7.1 GEOPHYSICAL SURVEYS

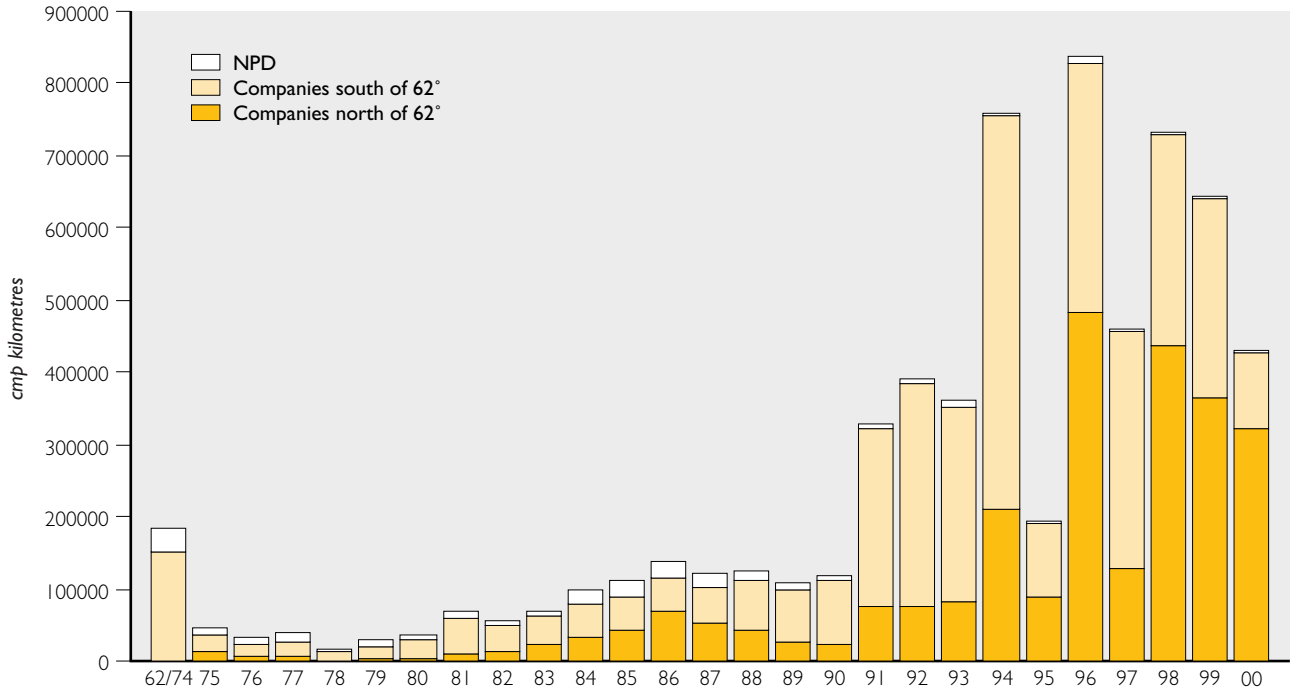
A total of 429,711 km of seismic data were acquired on the Norwegian shelf in 2000. The number of kilometers refers to cmp-line kilometers.

In the North Sea, a total of 102,923 km of seismic data were acquired, in addition to 278,824 km in the Norwegian Sea and 47,964 km in the Barents Sea.

Tabell 1.6.1
Licences for scientific exploration for natural resources

License	Name	Subject			Area
		Geo-physics	Geo-logy	Other	
330/2000	University of Gothenburg		X	Oceanography	Skagerrak
331/2000	Institut für Meereskunde University of Hamburg			Oceanography	Greenland Sea
332/2000	Finnish Institute of Marine Research			Geochemistry	Skagerrak
333/2000	Bundesanstalt für Landwirtschaft			Biochemistry	Barents Sea
334/2000	Institut für Meereskunde an der Universität Kiel			Geochemistry	Skagerrak
335/2000	Alfred Wegener Institut für Polar - und Meeresforschung		X	Biology	Greenland Sea
336/2000	University of Odense Institute of Biology			Biology	Skagerrak
337/2000	University of Tromsø		X		Andfjorden, Vestfjorden, Sularyggen
338/2000	University of Gothenburg		X	Oceanography	Skagerrak
339/2000	University of Gothenburg		X	Oceanography	Iddefjorden
340/2000	Southampton Oceanography Centre	X			Norwegian Sea
341/2000	Bundesanstalt für Landwirtschaft Ernährung			Biology	North Sea
342/2000	State Enterprise Polar Marine Geosurvey Expedition	X	X		Vøringplatået, Storegga
343/2000	Denmark's fishery studies			Biology	Skagerrak
344/2000	Natural Environment Research Council	X	X		Norwegian Sea
345/2000	Institute of Baltic Sea Research Warnemünde			Biology Geochemistry	Skagerrak
346/2000	Alfred Wegener Institut für Polar - und Meeresforschung		X	Oceanography Geochemistry	Skagerrak
347/2000	University of Gothenburg			Oceanography	Skagerrak
348/2000	Denmark's environmental studies			Oceanography	Skagerrak
349/2000	University of Tromsø	X	X		Fugløysundet, Stjernsund, Ytre Ullsfjorden, Andfjorden, Skrova, Trænadjupet, Indre Vestfjorden

Figure 1.7.1
Seismic acquisition on the Norwegian continental shelf 1962 - 2000



The Norwegian Petroleum Directorate acquired 4,084 km of seismic data on its own, while oil companies, seismic contractors and universities acquired 423,327 km. Of this total, Norwegian oil companies acquired 52,027 km and foreign oil companies acquired 140,351 km. The contractor companies Aker Geo, Fugro Geoteam, Geco, TGS-Nopec, PGS and Veritas DGC acquired 230,949 km for their own accounts. In collaboration with the Norwegian Petroleum Directorate, the University of Bergen acquired 2,300 km of seismic in the Norwegian Sea.

Of the total seismic data acquired, 3D seismic accounts for 405,224 km: 100,814 km in the North Sea, 256,698 km in the Norwegian Sea and 47,712 km in the Barents Sea. Figure 1.7.1 illustrates the development with regard to the number of cmp-line kilometers acquired.

1.8 PRODUCTION LICENSES

On 1 May 2000, 14 production licenses were awarded in the Norwegian Sea in the 16th licensing round. The award comprised 38 blocks or parts of blocks.

There have also been eight partitions in existing production licenses. These are production license 006 B (the Valhall field), 006 C (remaining area in the former production license 006 after partitioning of the Valhall and Tor fields), 027 C (supplemental area for the Ringhorne field), 028 C (partition from the Balder field), 037 C (supplemental area for the Murchison field), 134 B (supplemental area for 6406/2-3 Kristin), 169 B (supplemental area for the Grane field) and 171 B (supplemental area for the Oseberg Sør field).

Figure 1.9.1
Regional spread of exploration wells per operator 1965-2000

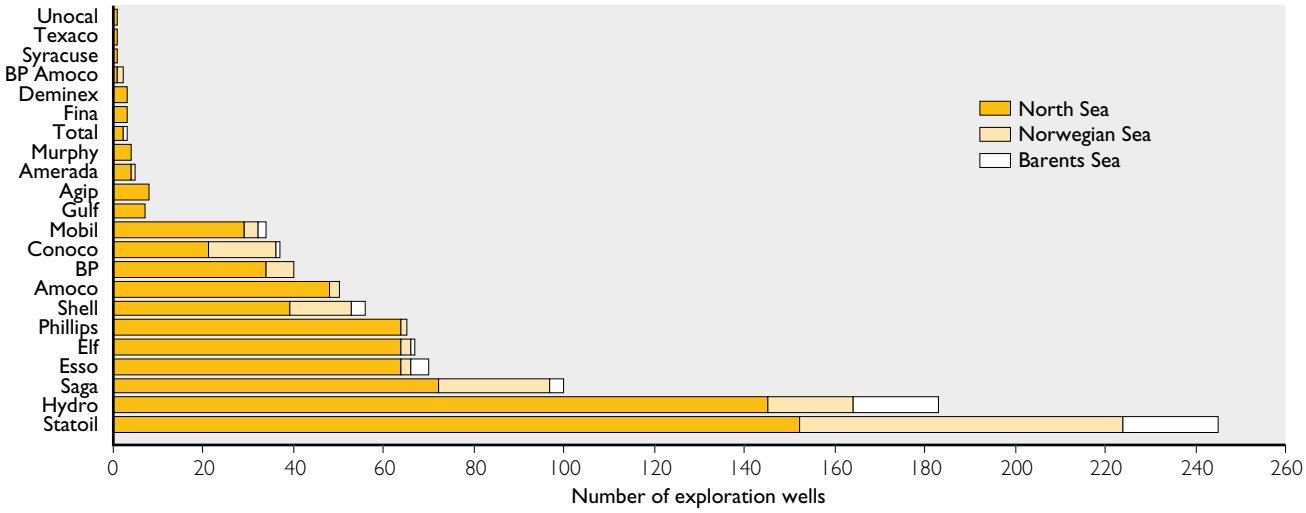


Table 1.9.1 Completed exploration wells in 2000

Exploration well	Well classification	Production license	Operator	Total vertical depth m (MSL)	Total depth (Age)	Status (31 Dec. 2000)
16/4-3	Wildcat well	243	BPAmoco	2425	Cretaceous	Dry
25/7-6	Appraisal well	203	Norsk Hydro	2224	Paleocene	Dry
3/6-1	Wildcat well	238	Norsk Agip	2133	Cretaceous	Dry
30/3-8 A	Appraisal well	052	Statoil	3274	Middle Jurassic	Dry
30/3-8 S	Appraisal well	052	Statoil	3328	Middle Jurassic	Dry
30/3-9	Wildcat well	052	Statoil	4022	Middle Jurassic	Gas/condensate
31/4-11	Wildcat well	055	Norsk Hydro	3245	Jurassic	Oil/gas
31/5-6	Wildcat well	191	Norsk Hydro	2344	Jurassic	Dry
34/4-10 IR	Wildcat well	057	Norsk Hydro	4244	Middle Jurassic	Oil
35/11-12	Wildcat well	248	Norsk Hydro	3354	Jurassic	Dry
6305/8-1	Appraisal well	209	Norsk Hydro	3150	Late Cretaceous	Oil/gas
6406/2-6 IR	Appraisal well	199	Statoil	4818	Early Jurassic	Gas/condensate
6407/7-6	Wildcat well	107	Norsk Hydro	3970	Early Jurassic	Oil
6506/6-1	Wildcat well	211	Mobil	5491	Early/Middle Jurassic	Dry
6507/5-3	Wildcat well	212	BPAmoco	2964	Late Cretaceous	Gas
6608/10-6	Wildcat well	128	Statoil	2115	Early Jurassic	Oil
6608/11-2	Wildcat well	128	Statoil	2215	Late Triassic	Oil
6710/10-1	Wildcat well	220	Statoil	2231	Late Cretaceous	Dry
7019/1-1	Wildcat well	201	Norsk Agip	2979	Early Jurassic	Gas
7122/7-1	Wildcat well	229	Norsk Agip	1500	Early Triassic	Oil
7216/11-1 S	Wildcat well	221	Norsk Hydro	3702	Late Paleocene	Dry

1.9 EXPLORATION ACTIVITY

1.9.1 EXPLORATION DRILLING

At the end of 1999/beginning of 2000, no exploration wells were being drilled.

24 exploration wells were spudded in 2000, of which 18 were wildcats and six were appraisal wells. These were distributed among seven wildcat wells and four appraisal wells in the North Sea, seven wildcat wells and two appraisal wells in the Norwegian Sea and four wildcat wells in the Barents Sea. In addition, three temporarily abandoned exploration wells were re-entered for further work; one in the North Sea and two in the Norwegian Sea.

At the end of 2000/beginning of 2001, three exploration wells were being drilled and 24 exploration wells were completed or temporarily abandoned.

The geographical distribution of the wells is as follows: seven wildcat wells and four appraisal wells in the North Sea, eight wildcat wells and two appraisal wells in the Norwegian Sea and three wildcat wells in the Barents Sea.

The operators for the wells completed or temporarily abandoned in 2000 were as follows: Statoil nine, Norsk Hydro seven, Norsk Agip three, BP Amoco and Saga (Norsk Hydro) two each and Phillips one. Regional distribution is shown in Figure 1.9.1. Completed exploration wells are shown in Table 1.9.1.

At the end of the year, a total of 988 exploration wells had been spudded on the Norwegian shelf. These are divided between 706 wildcat wells and 282 appraisal wells. 985 exploration wells were completed or temporarily abandoned. A total of 77 exploration wells have been reclassified: 72 from wildcat to appraisal wells and five from appraisal to wildcat wells. After reclassification,

Figure 1.9.2
Exploration wells completed per year after reclassification

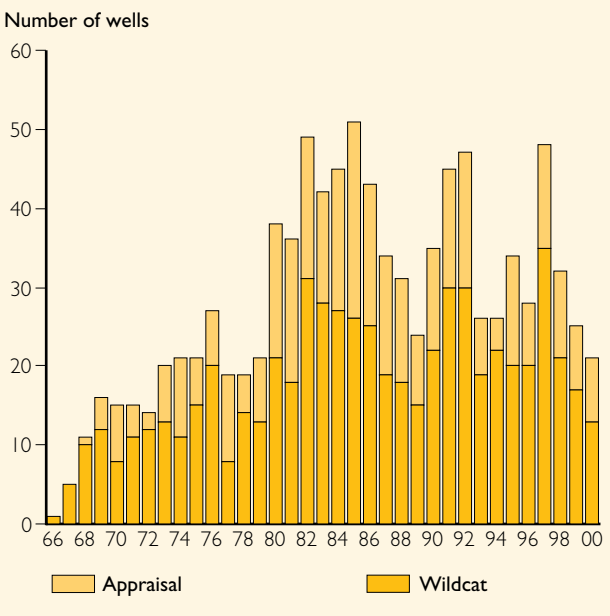


Table 1.9.2
Temporarily abandoned exploration wells

1/03-09 S	25/08-11	34/08-04 A
2/01-09 A	25/11-16	34/10-34
2/01-11	25/11-21 S	34/10-37 A
2/04-15 S	30/02-01	34/11-02 S
2/04-17	30/03-04	35/09-04 S
2/07-23 S	30/08-01 SR	6305/05-01
2/07-25 S	30/09-07	6406/02-02
2/07-31	30/09-08 R	6406/02-07
2/10-02	30/09-09	6407/07-02 R
2/12-02 S	30/09-10	6407/07-04
7/12-08	30/09-12 A	6506/06-01
7/12-09	30/09-13 S	6506/12-08
15/12-10	31/02-16 SR	6507/12-11 SR
25/02-13	31/02-18 A	6507/05-01
25/04-06 S	31/05-04 AR	6507/08-04
25/05-04	31/05-05	6608/10-06 R
25/08-06	34/04-07	6608/11-02

Table 1.9.3
New discoveries in 2000

Well	Operator	Hydrocarbon type	Reservoir level	Formation tested	Flow rate (per day)	Size of discovery (recoverable resources) Oil/condensate (million Sm_)	Size of discovery (recoverable resources) Gas (billion Sm_)
30/3-9	Statoil	Gas/cond.	Middle Jurassic	No		<1	<1
31/4-11	Norsk Hydro	Gas/oil	Middle Jurassic	No		1 - 2	
34/4-10	Norsk Hydro	Oil	Middle Jurassic/ Brent	No		1 - 2	
6407/7-6	Norsk Hydro	Gas/cond.	Early Jurassic	Yes	218 Sm^3 cond.	1 - 3	
6506/6-1	Esso	Gas	Early/Middle Jurassic	No			60 - 125
6507/5-3	BP	Gas	Late Cretaceous	No			20 - 40
6608/10-6	Statoil	Oil	Jurassic	No		13.5	
6608/11-2	Statoil	Oil	Early Jurassic	No		3	
7122/7-1	Norsk Agip	Oil	Middle Jurassic	No		12-17	
7019/1-1	Norsk Agip	Gas	Middle Jurassic	Yes	600000 m^3, 5/8" choke valve		1 - 2

these comprise 636 wildcat and 349 appraisal wells, see Figure 1.9.2.

As of the end of the year, a total of 51 exploration wells have been temporarily abandoned with equipment on the seabed. The temporarily abandoned exploration wells are listed in Table 1.9.2.

New discoveries 2000

Ten new discoveries were made on the Norwegian shelf during 2000, see Table 1.9.3. Two discoveries have been made in the Barents Sea, five in the Norwegian Sea and three in the North Sea. This gives a discovery rate of 50 per cent.

Detailed description of drilling in 2000.

The North Sea

Nine exploration wells were drilled in the North Sea in 2000, see Figures 1.9.3 and 1.9.4.

Exploration well 16/4-3 east of the Glitne field, with target in the Tertiary, was dry.

Well 3/6-1 was drilled in production license 238. It was completed in Cretaceous rocks and was dry. A minor gas discovery was made in 30/3-9 south of Huldra. It is extremely uncertain whether the discovery is commercial. Oil and gas were also proven in a previously unexplored layer on the flank of the Brage field with well 31/4-11. 25/7-6 was drilled as an appraisal well on the 25/7-5 discovery in production license 203, but the well was dry, thus proving that this structure does not lend itself to commercial development. Well 31/5-6 was drilled in a structure just west of Troll, but was dry.

Smaller quantities of hydrocarbons were proven in parts of the L prospect on the western flank of the Veslefrikk field with well 30/3-8 A. The possibility of commercial production of these reserves has not yet been clarified.

Well 35/11-12 was drilled in production license 248. Traces of hydrocarbons were proven in sandstone from the Late Jurassic Age.

Exploration well 34/4-10 R was drilled on the Delta prospect to the northwest of Snorre in production license 057 in the Tampen area. The well was drilled on a structural trap on the edge of the Marulk basin to test the prospectivity both in sandstones in the Heather formation of the Late Jurassic Age and in the Brent reservoir. The well was drilled to 4,244 m below sea level. Oil was proven in Brent sandstones of moderate to poor quality, while no sand was found in the Heather formation. The well was not tested, and the discovery is not considered to be commercial. The area has now been relinquished.

An appraisal well on Rimfaks confirmed the southern range of the deposit, and contributed to an increase in the reserves.

Norwegian Sea

Eight exploration wells were completed in this area in 2000, see Figure 1.9.5, while one drilling operation was underway at the end of the year. Of these, eight were wildcat wells and one was an appraisal well. Five new discoveries were made during the year.

Exploration well 6710/10-1 was drilled southwest of Lofoten in production license 220 in the Nordland VI area. 6710/10-1 was drilled on a dome structure to look for hydrocarbons in sandstones from the early Tertiary Age. The well was completed in rocks from the Late Cretaceous Age, and was dry.

Exploration well 6608/10-6 in production license 128 was drilled on a sloping fault block called Svale, about 10 km northwest of the Norne field. The well proved oil in sandstones from the Early, Middle and Late Jurassic Ages, but it was not production-tested. The oil-bearing sandsto-

Figure 1.9.3
Exploration wells drilled in the southern North Sea

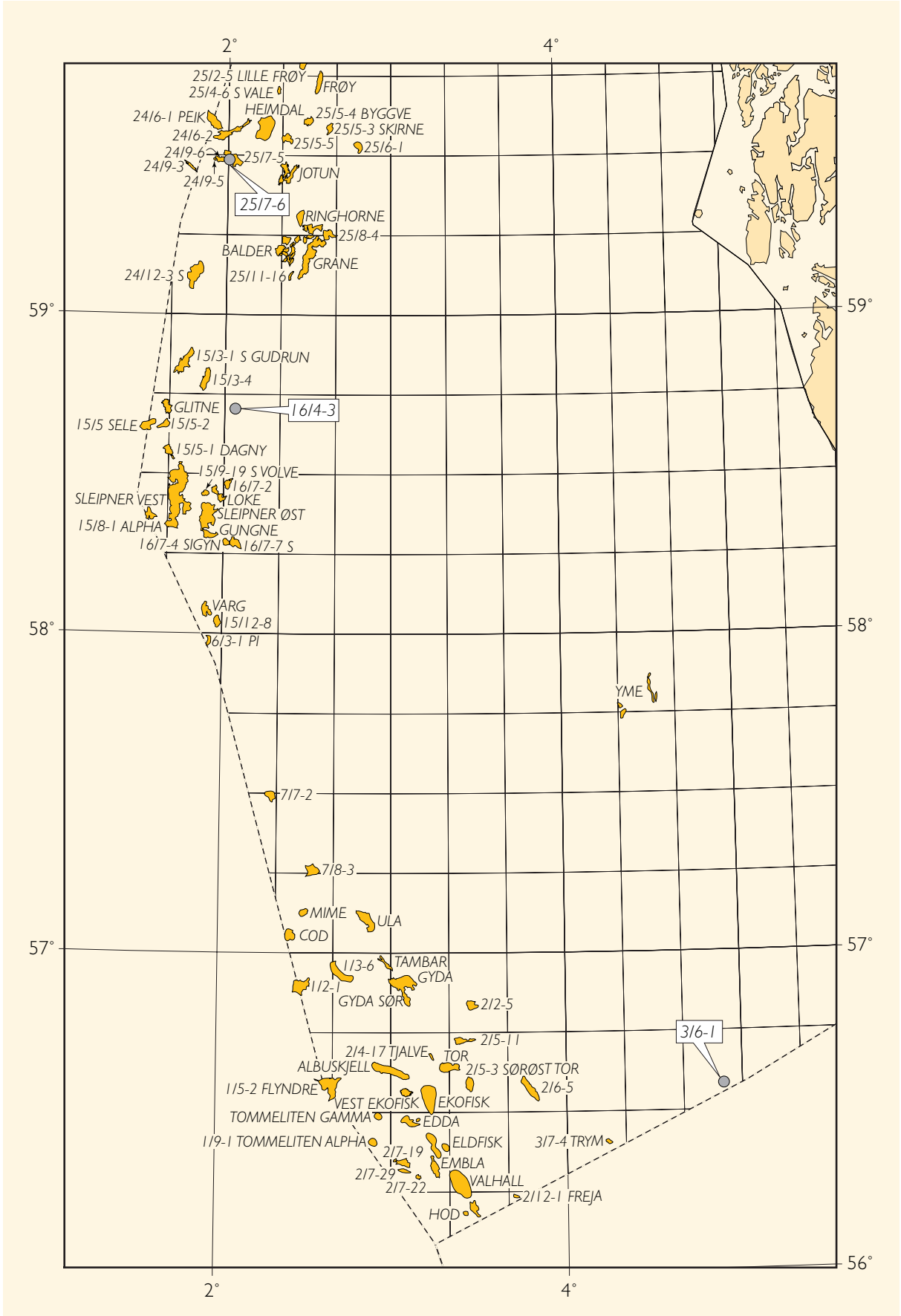


Figure 1.9.4
Exploration wells drilled in the northern North Sea

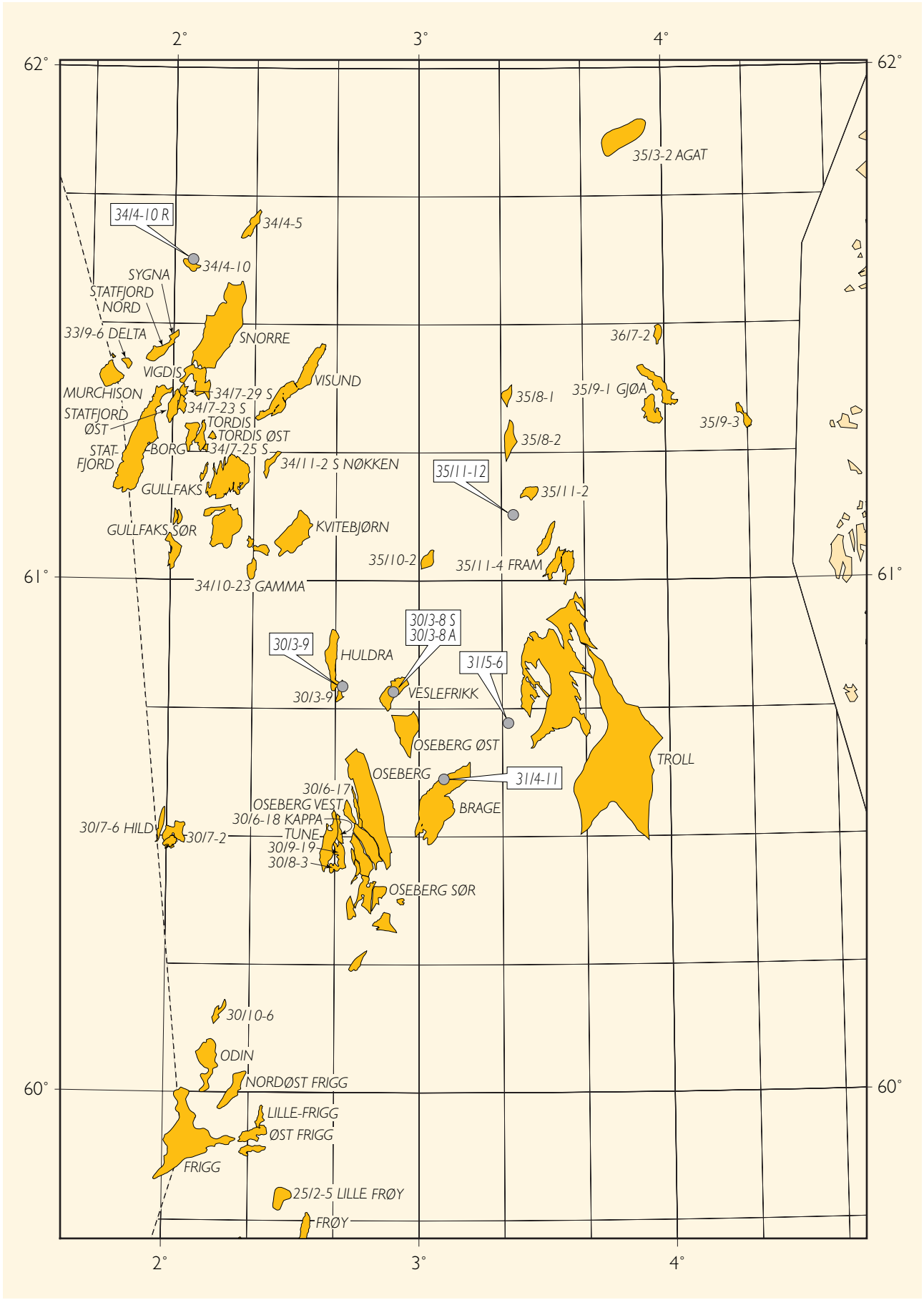


Figure 1.9.5
Exploration wells drilled in the Norwegian Sea

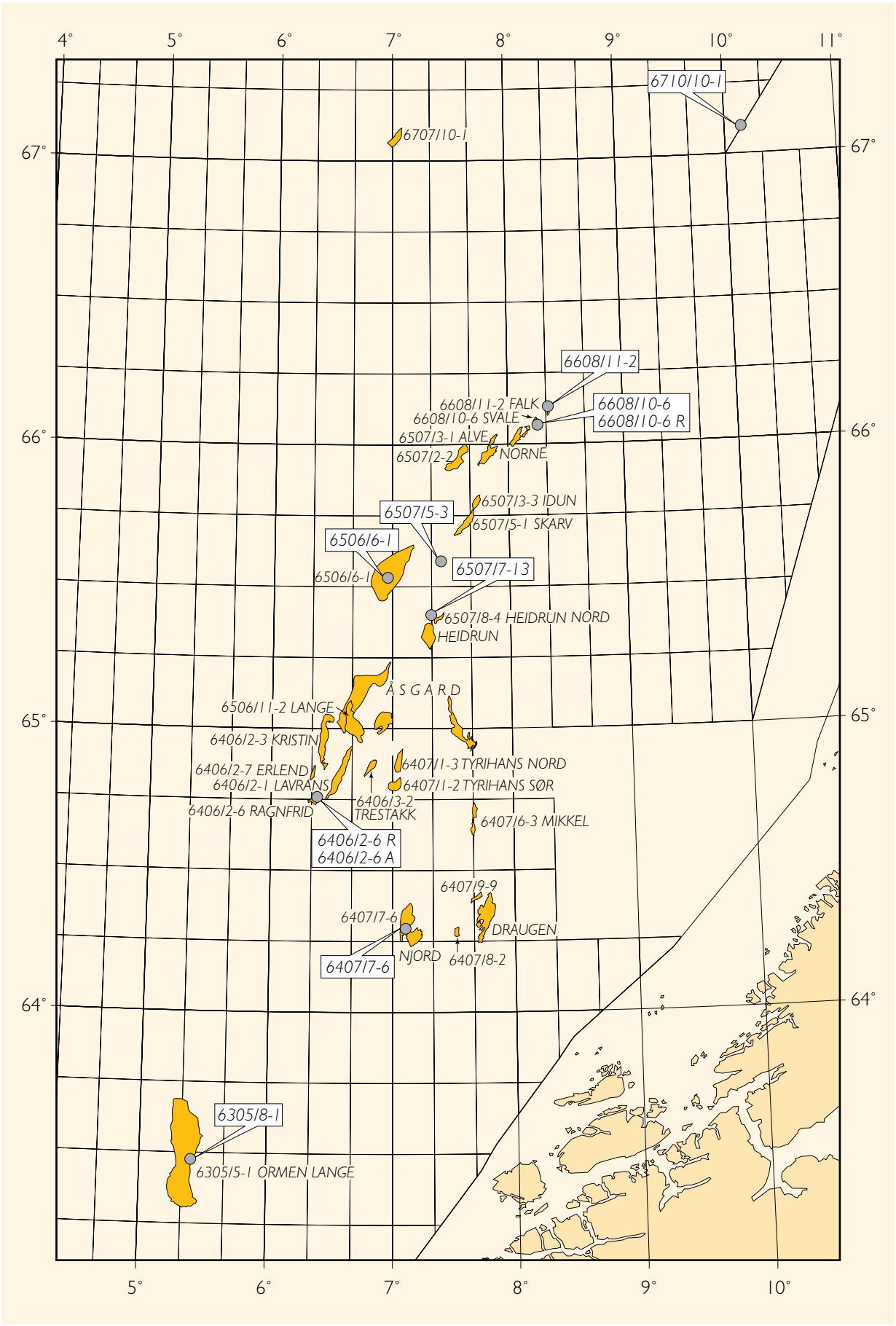


Figure 1.9.7
Annual exploration and planning costs

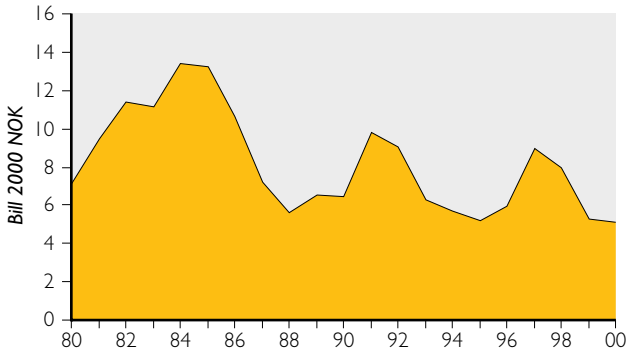
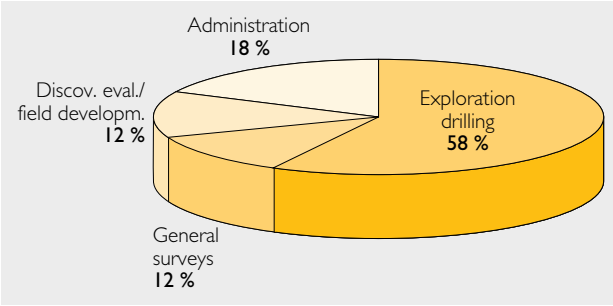


Figure 1.9.8
Percentage distribution of exploration cost for 2000



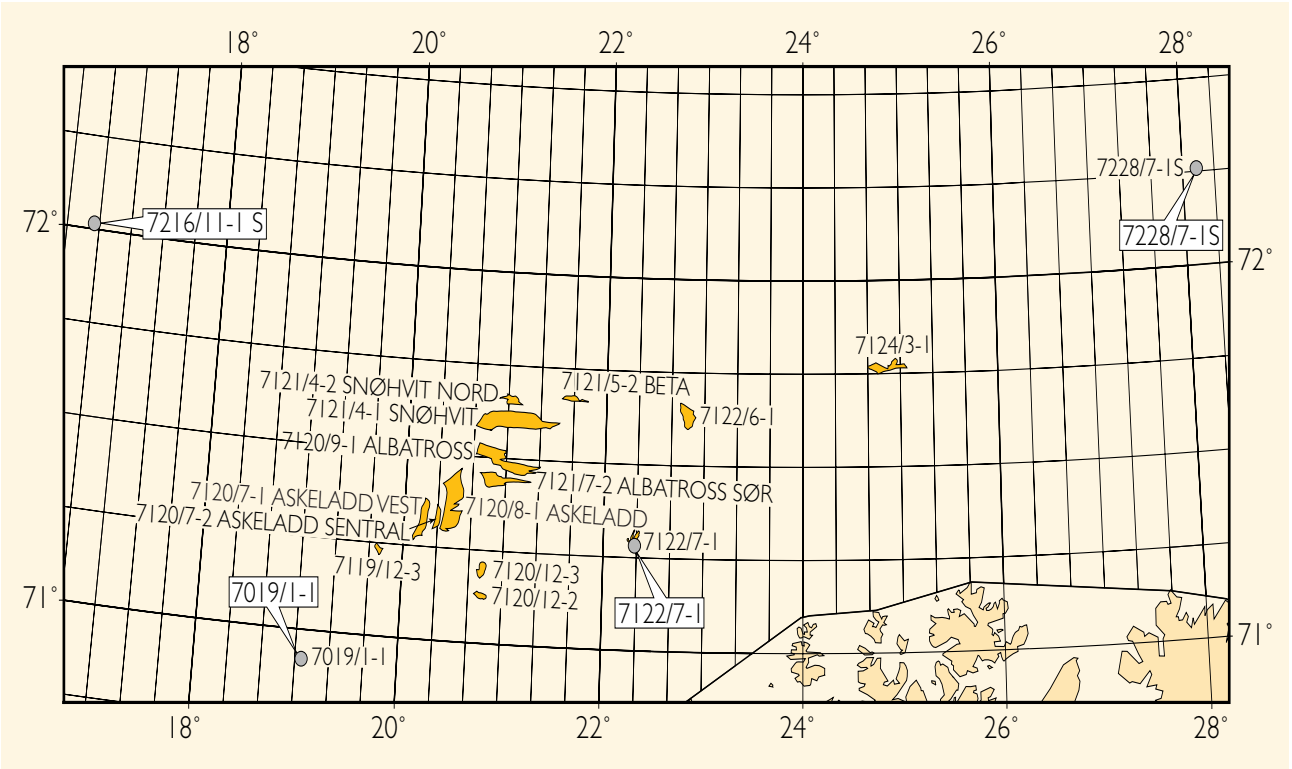
nes from the Late and Early Jurassic Ages have an upside potential downflank. The oil that was proven in sandstones of the Early Jurassic Age is biodegraded and has a low gas to oil ratio.

Exploration well 6608/11-2 in production license 128 was drilled on a rotated fault block called Falk, about 20 km northwest of the Norne field. The well proved oil in sandstones from the Early Jurassic Age. The well was not production-tested. The discovery indicates oil filling from the southwest via the Svale structure, and therefore opens up the possibility of making oil discoveries in prospects to the northeast of the Falk structure. The structure has an upside potential downflank in sandstones from the Early Jurassic Age.

Exploration well 6507/5-3 in production license 212 was drilled to investigate a prospect with sandstone from the Cretaceous Age. The well is located about 200 km off the Helgeland coast, and 17 km south of 6507/5-1, the Skarv discovery. Gas was discovered in sandstones from the Late Cretaceous Age. The discovery, called 6507/5-3 Snadd, will be additional resources to Skarv. The well was not tested.

To the west of the Skarv discovery, in exploration well 6506/6-1 (production license 211), gas was discovered in rocks from the Jurassic Age. Further analysis work and possibly appraisal wells will be necessary in order to estimate the volume of a potentially significant discovery. Due to technical problems with the well, it was not possible to implement the planned test.

Figure 1.9.6
Exploration wells drilled in the Barents Sea



Exploration well 6507/7-13 in production license 095 was spudded in December 2000 in order to test a prospect 10 km northwest of the Heidrun field.

Exploration well 6406/2-6 A in production license 199 was drilled to delimit the 6406/2-6 Ragnfrid discovery that was made in 1998. The discovery lies just south of the Kristin and Lavrans discoveries. The drilling was a sidetrack from well 6406/2-6 and was drilled down to rocks from the Early Jurassic Age. Gas/condensate was proven in sandstone layers from the Early Jurassic Age, but the well was not production-tested. The result of the drilling will lead to a downward adjustment of the original expected petroleum quantities in the discovery.

Exploration well 6407/7-6 was drilled in the autumn of 2000 in the unitized Njord, consisting of production licenses 107 and 132 The well was drilled in the B segment on the northwest flank of the field. Hydrocarbons were proven in sandstones of the Early Jurassic Age and a production test was carried out.

Norsk Hydro drilled appraisal well 6305/8-1 on the Ormen Lange discovery. The well confirmed an estimate of 400 billion Sm^3 gas. The well also proved a thin oil zone. Resources in place in the oil zone are in the order of 1-7 million Sm^3. A thin oil column 2-3 metres thick over the field will probably not be commercially exploitable, but the oil discovery is encouraging with a view towards the possibility of proving oil in deep water in the Norwegian Sea in the future.

Barents Sea

Three exploration wells, all wildcat wells, we completed in the Barents Sea in 2000, see Figure 1.9.6.

Exploration well 7216/11-1 S was drilled in production license 221 in the Sørvestsnag basin to look for hydrocarbons in sandstones from the Tertiary Age. The well was completed in rocks from the Paleocene (Early Tertiary) Age, and was dry.

Exploration well 7019/1-1 S was drilled in production license 201 in the Troms III area to look for hydrocarbons in sandstones from the Middle Jurassic Age. The well was completed in rocks from the Early Jurassic Age and proved gas in sandstones from the Middle Jurassic and Early Cretaceous Ages. The production test that was carried out showed that the gas contained large quantities of CO_2.

Exploration well 7122/7-1 S was drilled in production license 229 in the Hammerfest basin to look for hydrocarbons in sandstones from the Middle Jurassic Age.

Table 1.9.4
Exploration and planning costs

	Mill. NOK
Exploration drilling	2946
General surveys	607
Discovery evaluations	632
Administration[1)]	911
Total	**5096**

[1)] Administration costs include area fees

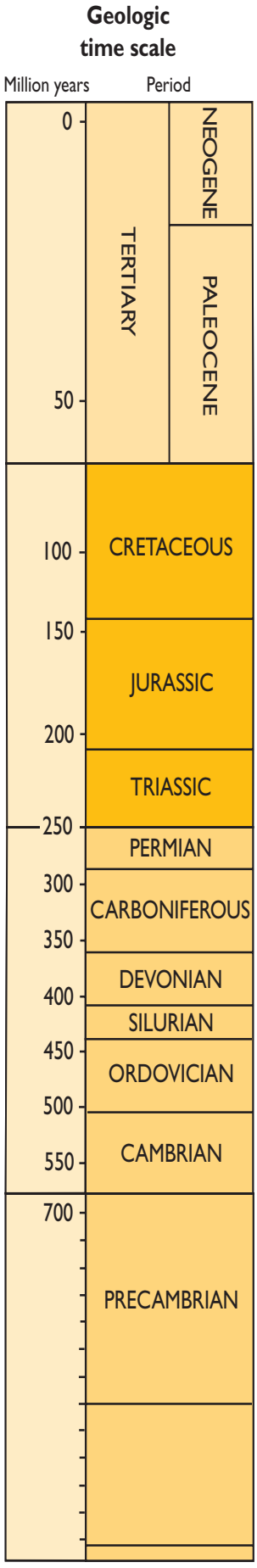


Figure 1.9.9
Average drilling cost per exploration well

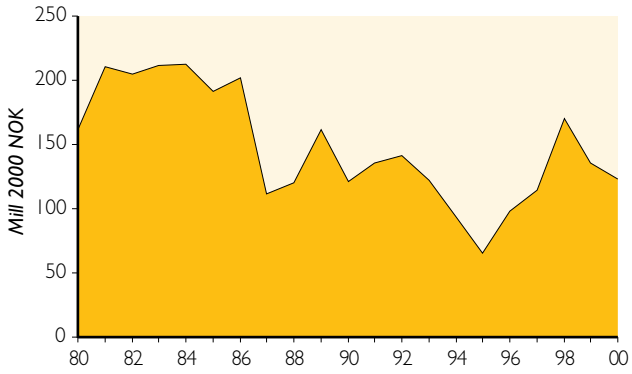
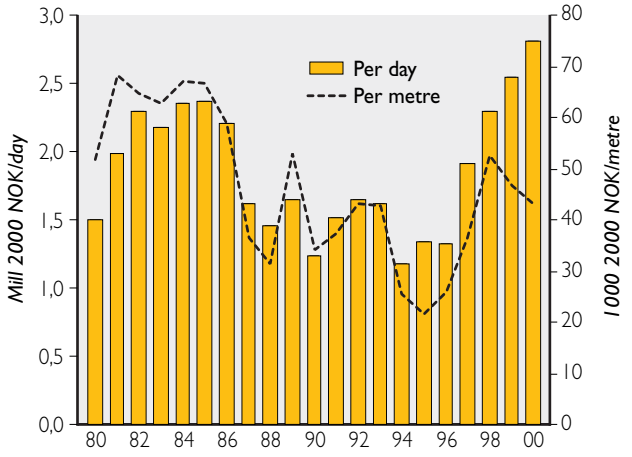


Figure 1.9.10
Average drilling cost per day and per metre drilled in 1980-2000



The well was completed in rocks from the Late Triassic Age and proved oil. The well was not production-tested. The discovery opens up the possibilities of making oil discoveries in other prospects in the area.

Exploration well 7228/7-1 was spudded in December 2000 in the Nordkapp basin.

1.9.2 EXPLORATION COSTS

In 2000, 24 exploration wells were spudded, while the number of exploration wells in 1999 was 22. Of the 24 wells, 18 were wildcat wells and six were appraisal wells. Corresponding figures for 1999 were 15 and seven. During the period from 1966-2000, the number of spudded wildcat and appraisal wells has averaged 20 and 8 respectively.

Figure 1.9.7 shows the costs of exploration and planning activities from and including 1980. The costs include exploration drilling, general surveys, discovery evaluations and administration. General surveys include inter alia acquisition of seismic data. According to figures reported to the Norwegian Petroleum Directorate, the total exploration costs in the years 1980-2000 amount to approximately 171 billion 2000-NOK.

Table 1.9.4 shows the exploration and planning costs for 2000 distributed among different types of costs. The figures are based on data reported by the operating companies. The same figures are used as a basis for Figure 1.9.8, which shows the cost distribution in per cent.

In 2000, the share of exploration costs related to exploration drilling was 58 per cent, while the corresponding figure for 1999 is 57 per cent. Expenses related to general surveys constituted 12 per cent in 2000 compared with 11 per cent in 1999.

Figure 1.9.9 shows the average drilling costs per exploration well, i.e. wildcat and appraisal wells. In 1999, drilling was carried out at a cost of around NOK 2.95 billion, and the cost per well is estimated to be about NOK 123 million. This is a slight decline compared with 1999 when drilling costs per well were about NOK 135 million. However, the total drilling costs have remained about constant for the years 1999 and 2000.
Figure 1.9.10 shows the average drilling costs per day and per metre drilled in the years 1980-2000.

1.10 DEVELOPMENT AND OPERATIONS

Previously, the annual report has contained detailed information on each individual field. This year's edition contains area descriptions. Factual information may be found on our web site: www.npd.no. Descriptions of fields, etc. may also be found in Fakta 2000: www.oed.dep.no, published by the Ministry of Petroleum and Energy.

1.10.1 THE SOUTHERN NORTH SEA

The southern North Sea, see Figure 1.10.1, comprises fields in the Valhall area, the Ekofisk area, the Ula-Gyda area, the Sleipner area and the Balder area. In addition comes the Yme field, located on Egersundbanken.

The Ula – Gyda area comprises the fields Ula, Gyda, Gyda Sør and Tambar.

Ula has been developed with three steel installations for production, drilling and living quarters. The main reservoir is in sandstone from the Jurassic Age and contains oil and gas. The oil is transported in a pipeline via Ekofisk to Teesside, while gas and produced water are reinjected. Water injection is the main drive mechanism.

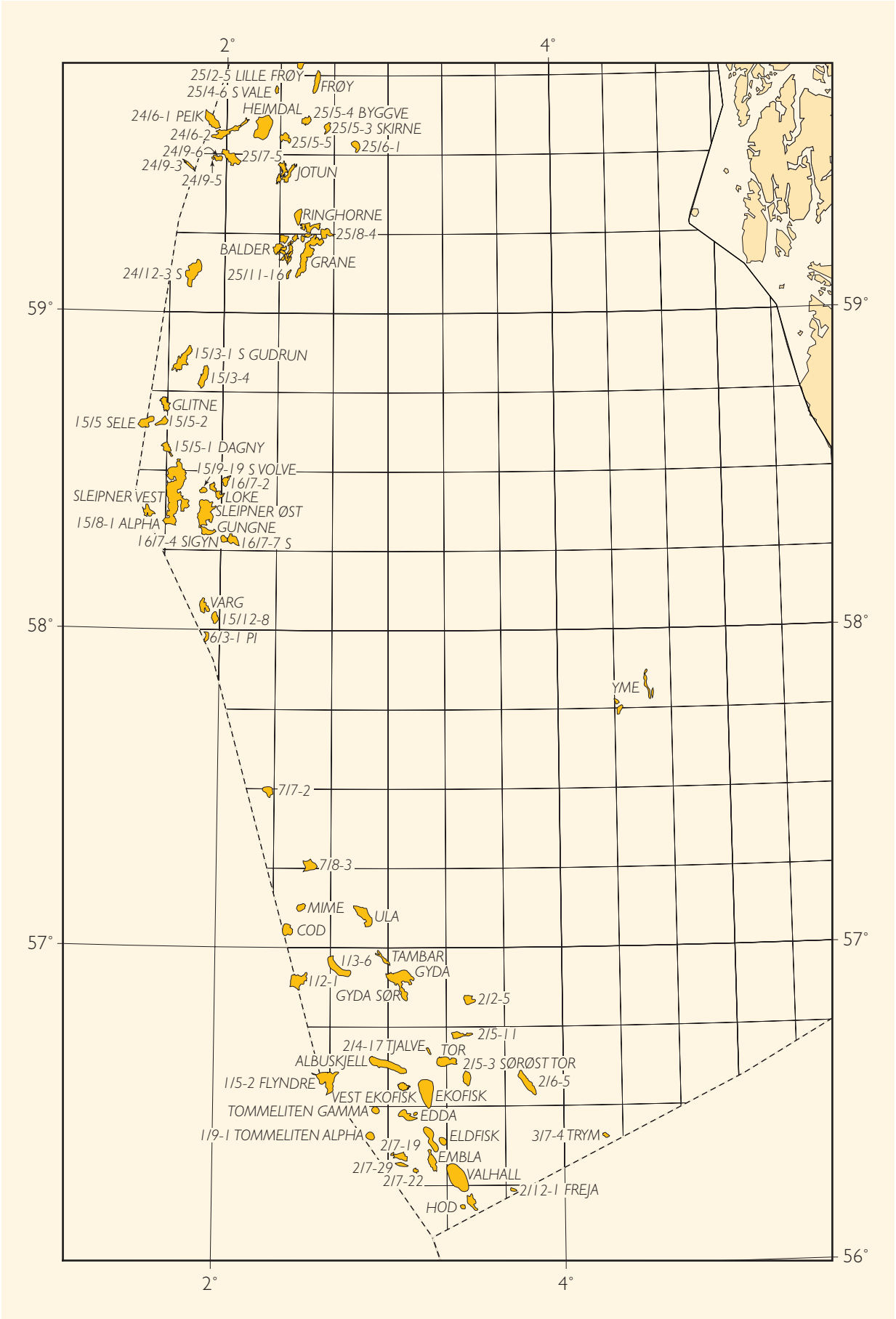
The development solution on **the Gyda field** consists of a combined drilling, production and living quarters installation. The reservoir consists of Upper Jurassic sandstone and water injection is the drive mechanism. The oil and gas are transported via pipeline to Ekofisk.

Gyda Sør is an oil field, and the oil is produced from the Gyda field via two long-range wells.

The plan for development and operation of **the Tambar field** was approved in 2000. The field has a simple development concept consisting of an unmanned installation with remote control from and processing on Ula.

The gas from Tambar will be used for alternating water and gas injection in Ula, thus increasing production and lifetime for Ula. It has also been decided that a gas pipeline will be laid between Ula and Gyda. This will increase

Figure 1.10.1
Fields and discoveries in the southern North Sea



flexibility and provide additional opportunities for gas injection in the Ula reservoir, as well as provide export opportunities for the reproduced gas.

The Ministry of Petroleum and Energy has adopted a substantial reduction of the tariff in the oil pipeline between Ula and Ekofisk in order to ensure that the creation of value takes place as much as possible through the operation of the field.

The Ekofisk area comprises the fields Ekofisk, Vest Ekofisk, Albuskjell, Tor, Eldfisk, Embla, Edda, and Cod, which are operated by Phillips Petroleum Company Norway and Tommeliten Gamma, which is operated by Statoil. Production from the area largely takes place from limestone rocks, while Embla produces from sandstone of the Devon and Jurassic Ages.

Production from **Ekofisk** started in 1971 and the **Cod, Tor** and **Vest Ekofisk** fields were developed and tied-in to the Ekofisk Center in the years 1976 – 1978. At the same time, an oil pipeline was laid to Teesside and a gas pipeline to Emden. In 1979, the **Albuskjell, Edda** and **Eldfisk** fields were tied in to the Ekofisk Center. These fields have reservoirs from the Early Paleocene and Late Cretaceous Ages. Production from **Embla** started in 1993 from rocks from the Devon, Permian and Jurassic Ages. With the exception of the concrete tank, the installations have been built with steel jackets.

The Ekofisk field has been in operation for almost 30 years and has a combination of old and new infrastructure. Due to the subsidence of the seabed and aging installations, development of Ekofisk II was decided in 1994. The development included a drilling and wellhead installation and an integrated process and export installation. The new installation was put into operation in August 1998 and Eldfisk, Tor and Embla were tied in to the new center. At the same time, the installations on Albuskjell, Cod, Edda and Vest Ekofisk were shut down. The same was the case for Tommeliten Gamma.

A study has been initiated to increase production from the Ekofisk area. The subsidence rate on the Ekofisk field has declined so that several of the installations discussed in the cessation plan for Ekofisk I can have extended lifetimes. The result of the study may be an increase in drilling activity, as well as major modifications to the installations in the area to increase the process capacity. In 2000, water injection on Eldfisk was started first, with export to Ekofisk, after which gas injection was started on Eldfisk. The installation that was installed on Eldfisk in connection with the water injection project was the first on the Norwegian shelf to generate electricity using surplus heat. Phillips Petroleum Company Norway received the Norwegian Petroleum Directorate's IOR prize for 2000 for its work on the Ekofisk field.

The Valhall area comprises the Valhall and Hod fields. The reservoirs consist of limestones from the Early Paleocene to the Late Cretaceous Ages. **Valhall** has been developed with living quarters, drilling, production and riser installations. Oil and NGL are transported by pipeline to the Ekofisk Center for further transportation to Teesside. Gas is transported in a pipeline to Norpipe for further transportation to Emden.

The Hod field is produced using depressurization and is developed with a simple production installation remote controlled from the Valhall field. Oil and gas are transported to Valhall.

In 2000, the plan for development and operation of water injection on Valhall was approved. It was also decided that a pipeline would be laid between Valhall and Hod for gas lift. This will mean increased production and extended lifetime for the Hod field. In connection with the water injection project, the production license was extended to 2028 and the production royalty was lifted. Further plans for Valhall include possible wellhead installations on the flanks as well as replacement of the process installation and living quarters due to subsidence on the field.

A cessation plan for **Yme** was submitted in 2000, and notice was given for termination of the contracts for the hired installations. In order to maintain production, several sidetracks have been drilled that were not originally planned for 2000. This was a direct result of high oil prices and has resulted in some extra production and lifetime. Production takes place from sandstones of the Middle and Late Jurassic Ages.

In addition to the producing fields, there is some activity in connection with discoveries. Amerada Hess is the operator for 2/12-1 Freja, where a study has been commenced that may lead to a plan for development and operation in 2001. The most likely development concept is a subsea development with processing on Valhall or a Danish field. Consideration is being given to developing the 1/2-1 discovery from the British side, and studies are underway to evaluate resource distribution and development solutions. Within the Ekofisk area, there is the possibility that discoveries or remaining resources in shutdown fields may be developed as processing capacity becomes available on Ekofisk.

The Sleipner area

The Sleipner fields comprise Sleipner Øst, Sleipner Vest, Gungne and Loke, all of which are in operation.

Agreements regarding coordinated operations, injection and sale have been signed for these fields. The gas is transported via pipeline, both to Zeebrügge in Belgium, through Statpipe/Norpipe and through the Europipe system to Emden in Germany. A small quantity of gas is sold to Ekofisk. The condensate is landed at Kårstø through a 250-km pipeline from Sleipner R to Kårstø.

Sleipner Øst contains gas and condensate in the Ty and Hugin formations from the Tertiary and Jurassic Ages respectively. The main reservoir is in the Ty formation. Some gas has also been proven in the underlying formations from the Cretaceous and Triassic Ages. A new production/injection well was drilled in the Ty reservoir

in 2000. A new reservoir model showed that the Hugin reservoir on Sleipner Øst was in communication with the reservoir in Loke Triassic. An application to incorporate Loke in Sleipner Øst was submitted.

The field has been developed with an integrated process, drilling and living quarters installation with a concrete substructure (Sleipner A). In addition, a separate riser installation has been built (Sleipner R) with a gangway to Sleipner A. A subsea template has been installed for production of the northern part of Sleipner Øst. **Loke** is also produced via a dedicated subsea template.

An exemption was granted in 2000 for a plan for development and operation of the 15/9-20 S discovery under Sleipner Øst. The plan is to produce the discovery using an existing well.

Production from **Gungne** takes place using one well from Sleipner A. Drilling of a new production well started in 2000.

Sleipner Vest contains gas/condensate with an underlying oil zone in some areas. The reservoir lies in the Hugin formation from the Jurassic Age. Gas/condensate is produced using depressurization and pressure maintenance from the underlying water zone. So far, it has been impossible to find a profitable concept for producing the oil. Dry gas not needed for meeting sales obligations has been injected in Sleipner Øst. The gas in Sleipner Vest contains up to nine volume per cent CO_2, which is separated from the gas and injected into the Utsira formation.

The first phase of the development of Sleipner Vest comprised a wellhead installation, Sleipner B, and an installation for processing and removal of CO_2, Sleipner T. Sleipner B is located in the southern part of Sleipner Vest. From Sleipner B, the well stream is routed to Sleipner T, which has a gangway to Sleipner A. In 2000, it was decided that the West Epsilon drilling installation would be removed from Sleipner Vest and Sleipner B will thereafter be operated without permanent manning.

Considerable activity has gone on in 2000 to plan the next phase of Sleipner Vest to expand the compression capacity. Several different solutions have been considered and a final decision is expected in 2001.

Varg contains oil in a greatly faulted sandstone reservoir from the Late Jurassic Age. The production strategy is based on the use of alternating water/gas injection. The plan for development and operation was approved in May 1996. Production started at the end of 1998 and injection of water and gas started in early 1999. Varg is produced with a chartered production ship tied to a wellhead installation. A cessation plan for the field was submitted din 2000. Exploration well 15/12-12 was spudded on a prospect to the south of Varg.

Glitne is a small oil field located to the north of Sleipner. The plan for development and operation was approved in 2000 and pre-drilling of production wells started towards the end of the year. The development concept consists of a production vessel (Petrojarl 1). Due to the field's short lifetime, the cessation plan was submitted together with the plan for development and operation.

15/5-1 Dagny is a gas and condensate discovery in Jurassic rocks to the north of Sleipner Vest. The most interesting development concept is subsea wells or an unmanned wellhead installation connected to Sleipner A. A potential development could also include the 15/5-2 discovery further north.

15/9-19 S Volve is an oil discovery to the north of Sleipner Øst. Oil has been proven in source rock from the Jurassic and Triassic Ages. Use of a production vessel is a possible development solution.

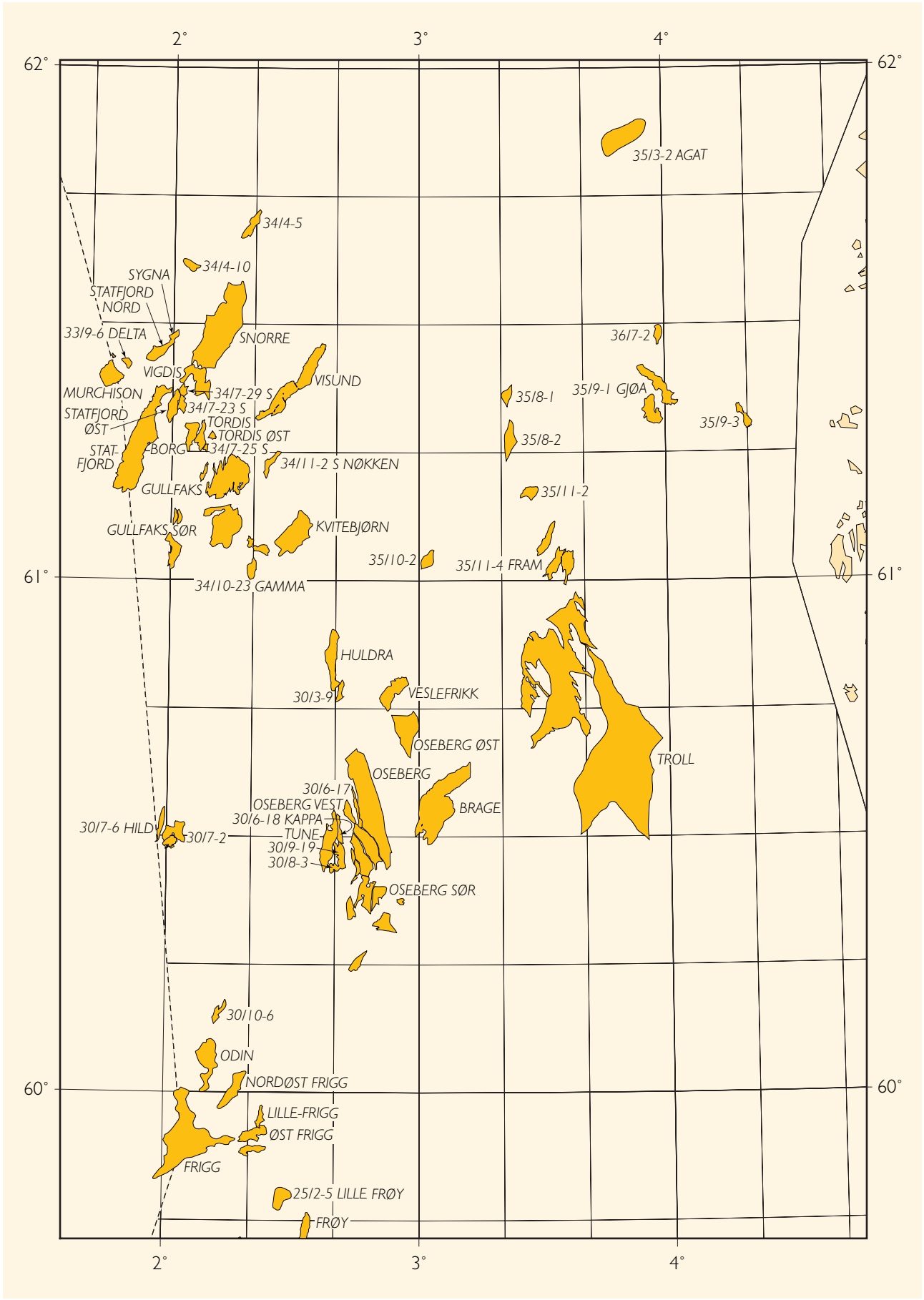
16/7-4 Sigyn lies about 12 kilometres southeast of Sleipner A. The main reservoir lies in the Skagerrak formation and contains gas/condensate and light oil. Work is underway on a development of the discovery with subsea-completed wells as a satellite to Sleipner A. Studies were conducted in 2000 with a view towards submitting a plan for development and operation in 2001. Esso as operator of Sigyn and Statoil as operator of Sleipner A and the licensees in production license 072 want a joint implementation of the development project.

The Balder area comprises the Balder, Ringhorne, Jotun and Grane fields. Balder and Jotun were both put into production in September 1999. The plans for development and operation of Ringhorne and Grane were both approved by the authorities in 2000.

Balder consists of several separated structures with sandstone on several stratigraphic levels. Subsea-completed wells are tied in to the Balder ship where oil and gas are processed. The oil is exported via tankers. The field is produced using natural water drive and water injection. According to the plan, all produced water shall be reinjected. Produced gas is reinjected in a well on the field, but throughout large parts of 2000, compressor problems on the Balder ship resulted in much of the produced gas being flared. The water cut from the wells has been greater than anticipated and the oil production has been significantly lower.

Jotun consists of three structures extending between production license 027 B and production license 103. An agreement concerning unitization between the two production licenses was signed in the autumn of 1997. The field is primarily produced using natural water drive, but has a water injection well as pressure support. Drilling of production wells has gone on throughout 2000 and the first phase of the drilling will be concluded in the beginning of 2001. The production rate from Jotun has been surprisingly good, but the water cut in the wells has gradually become high. The oil is loaded on the field and the gas exported via Statpipe.

Figure 1.10.2
Fields and discoveries in the northern North Sea



Ringhorne comprises several structures in the immediate vicinity of Balder. Oil has been proven in sandstone from the Jurassic, Paleocene and Eocene Ages. The plan for development and operation was approved by the authorities in November 2000 after production rights agreements were signed with the surrounding production licenses 027 B and 169. The planned development concept is a wellhead installation and subsea-completed wells tied in to the Balder ship. The intention is for separation to take place on the Ringhorne installation and Balder. The field will be produced using water injection and natural water drive. The intention is to start production from subsea-completed wells in 2001 and from the wellhead installation in 2002. The first production well as spudded in 2000.

Grane contains relatively heavy oil. The plan for development and operation of the deposit was approved by the authorities in 2000. The plan entails development with a manned production installation with steel jacket. The plan also includes a pipeline from Grane to the Sture Terminal for export of oil as well as a pipeline from Heimdal to Grane for transportation of injection gas. The main drive mechanism for Grane will be gas injection. The work schedule entails that production will commence in 2003.

1.10.2 THE NORTHERN NORTH SEA

The northern part of the North Sea comprises the main areas Frigg/ Heimdal, Oseberg, Troll, Sogn and Tampen, see Figure 1.10.2.

The Frigg/Heimdal area

Frigg produces gas from the Frigg formation, which consists of sandstone from the Eocene Age. The production wells on CDP1 are permanently plugged. On DP2, the wells have reduced production potential due to water influx. Future development of produced water volume will be a crucial factor in determining when the field will be shut down. According to current plans, the last year of production will be 2002. The field was developed in three phases. Phase I, which started in 1977, consists of one production and one treatment installation on the British part of the field, as well as a living quarters installation. Phase II started in 1978 and consists of a production installation and a treatment installation on the Norwegian part of the field. Phase III of the development commenced operations in the autumn of 1981 and comprised the installation of three turbine-driven compressors on TCP2. Transportation of gas from the Alwyn North field on the British side takes place via Frigg. The gas is transported 355 km to St. Fergus in Scotland through two pipelines. The liquid is transported in Frostpipe via Oseberg to the Sture terminal.

Frøy was developed by means of a wellhead installation. Oil and gas are transferred in separate pipelines to Frigg for further processing and metering. The gas is transported on to St. Fergus. The oil is transported in Frostpipe to Oseberg, and from there on to the oil terminal at Stura. The production strategy is based on water injection. The field is currently producing from two wells. The plan is to produce until the spring of 2001. Today Frøy has low production and relatively high operating costs.

Heimdal was developed with an integrated steel jacket structure with drilling, production and living quarters functions. The deliveries of gas via Emden began in February 1986. The gas pipeline from Heimdal is tied into the Statpipe system at the Draupner riser installation. The condensate is transported from Heimdal to Brae in the British sector through a separate pipeline. From the Brae field the condensate goes to Cruden Bay in Scotland. After a modification phase, the installation is once again in operation. The remaining reserves on the field are being produced. The gas from Huldra will be processed on Heimdal starting from the autumn of 2001. The gas from the Oseberg field is now transported via the new riser installation on Heimdal.

The plan is to develop **Vale** with a production well drilled from a subsea installation and tied in via pipeline to the Heimdal installation. The plan for development and operation was submitted to the authorities in November 2000. Planned production start-up for Vale is scheduled for December 2001. The condensate will be sent via the Heimdal condensate pipeline to Brae A, and from there through the Forties system to the U.K. The gas will be sent through Statpipe/Norpipe to the continent.

25/5-3 Skirne and **25/5-4 Byggve** are two gas discoveries east of Heimdal. The plan for development and operation may be submitted to the authorities during 2001. The plan is to develop the discoveries using a subsea installation linked to Heimdal.

The Oseberg area comprises the Oseberg, Oseberg Vest, Oseberg Øst, Oseberg Sør, Brage, Veslefrikk, Huldra and Tune fields. Oseberg Sør started producing in 2000, according to plan, Huldra and Tune will start producing in 2001 and 2002 respectively.

Oseberg is an oil field with a gas cap. The oil is produced using gas injection, water injection and WAG. The injection gas has been imported from Troll Øst (TOGI) and Oseberg Vest.

The Oseberg field center, with the Oseberg A, B and D installations, comprises a junction and processing center that the other fields are linked to. Oseberg A comprises a processing and living quarters installation with a concrete gravity base structure, and Oseberg B comprises a drilling and water injection installation with a steel jacket. Oseberg D is constructed with a steel jacket and handles dry gas processing and gas export. Gas exports from Oseberg commenced on 1 October 10 through a new pipeline to the Statpipe system via the Heimdal installation. The oil from the field center is transported via pipeline to the Sture

terminal. The northern part of Oseberg is developed with the Oseberg C installation which has a steel jacket and is a production, drilling and living quarters installation (PDQ).

Oseberg Vest is a small satellite field to Oseberg, containing gas and oil. The field is developed with two subsea-completed wells tied in to the main field. All produced gas is injected into the Oseberg field.

Three other minor discoveries containing oil and gas have been made on the Oseberg west flank, 30/9-19, 30/6-17 and 30/6-18. Work is underway on plans for developing these discoveries.

Oseberg Øst is an oil field, produced with the aid of water and alternating water and gas injection. The field has been developed with an installation with living quarters, drilling equipment and first stage separation of oil, water and gas. Processing will be completed at the Oseberg field center.

The Oseberg Sør field commenced production in 2000. This is an oil field that also contains some gas and consists of a number of reservoir structures. Seven of these structures are incorporated in the approved development plan. The oil is produced using water injection, gas injection and alternating water and gas injection for pressure maintenance. The gas is reinjected and potential gas export will take place in a later phase. The field has been developed with an installation with a steel jacket and facilities for first stage separation of oil and gas. Processing will be completed at the Oseberg field center. The oil will be transported in the Oseberg Transport System (OTS) to the Sture terminal. Some of the reservoirs will be produced using wells from two subsea templates that will be tied in to the production installation with pipelines. A part of the northernmost reservoir structure can be reached by wells from the Oseberg field center, and will be produced from there.

Tune is a gas/condensate field consisting of two main structures: the A and B structures. Gas/condensate has been proven in the A structure. The plan for development and operation was approved in December 1999. The plan is to develop the field in two phases. Tune will be developed as a subsea development with transportation of the well stream to Oseberg. The field has been allocated gas based on development of the A structure.

Brage is an oil field with some gas, produced using water injection in the Statfjord formation and water and alternating water and gas injection in the Fensfjord formation. Production from the Sognefjord formation was resumed in 2000, after having been shut down in 1999 due to high water cut and limited water treatment capacity. The water injection pipes to Fensfjord were replaced in 2000 due to extensive corrosion. Brage has been developed with an integrated production, drilling and living quarters installation with a steel jacket. The oil is transported via pipeline to Oseberg and on through the Oseberg Transport System to the Sture Terminal. A pipeline for gas is connected to Statpipe. In 2000, an exploration well was also drilled on the north flank of Brage, 31/4-11, which proved oil and gas.

Veslefrikk is developed with a floating production installation and a drilling installation with a steel jacket. The oil is sent via pipeline to the Sture terminal. Gas is transported via the Statpipe system. The production strategy is pressure maintenance using water, dry gas and WAG injection. After 11 years of production, the field is now in the decline phase, however, the field has so far produced a larger volume than was anticipated in the plan for development and operation.

Huldra is a gas discovery that was proven in 1982. The plan for development and operation of Huldra and the plan for installation and operation of the pipelines have been approved. The development concept is based on an unmanned wellhead installation. Huldra has received gas allocation and start-up of gas deliveries is planned for October 2001. After first stage separation, gas and condensate will be transported to Heimdal and Veslefrikk respectively for final processing. Pre-drilling of wells started in 2000.

The Troll area comprises Troll Phase I (gas production from Troll Øst), Troll Phase II (oil production from Troll Vest), TOGI and Sogn (i.e. the discoveries in Fram, Gjøa and production license 248). The plan for development and operation of Fram Vest was submitted to the authorities in December 2000.

The Troll field comprises both Troll Øst and Troll Vest and is unitized. Both Troll Øst and Troll Vest contain large volumes of gas. In addition, the Troll Vest oil province contains an oil column of 22-26 metres under the gas cap, and the Troll Vest gas province contains an oil column of 11.5-14.5 metres under the gas cap.

The gas reserves in Troll Øst are produced from Troll A, which is a permanent wellhead installation with a concrete gravity base structure. The gas is transported via two multi-phase pipelines to the gas treatment facility at Kollsnes. At the land facility, the condensate is separated from the gas and transported through a pipeline to the Sture Terminal. From here, the condensate is in part exported to the market, and in part sent via pipeline to Mongstad for further processing. The dry gas is compressed and exported via pipeline to the Continent. The Kollsnes facility has an export capacity of 100 million Sm^3 gas per day.

The oil reserves in the Troll Vest oil province and gas province are produced via Troll B and Troll C. The oil zones are produced using horizontal wells that are drilled from subsea templates tied in to Troll B and C. A decision has been made for a total of 17 well clusters, each consisting of one or two subsea templates. The plan for development

and operation of the latest template, called the P2 subsea template, was approved in 2000. During the year, it was decided that a number of new horizontal wells would be drilled so that the oil reserves for the field increased during 2000 from 195 million Sm^3 to 211 million Sm^3. The oil from Troll B, which is a floating concrete installation, is transported via the Troll Oljerør I (Troll oil pipeline) to Mongstad. The oil from Troll C, which is a floating steel installation, is also transported to Mongstad through Troll Oljerør II. The gas that is produced with the oil is in part reinjected, in part transported via Troll A to Kollsnes.

The subsea system Troll Oseberg Gas Injection **(TOGI)**, is controlled from the Oseberg Field Center and produces gas from Troll Øst for injection in the Oseberg field.

The **Sogn area** lies to the north of Troll and consists of the discoveries in production license 090 (35/11-4 Fram), production license 153 (35/9-1 Gjøa) and production license 248. The plan for development and operation of the oil discovery Fram Vest was submitted to the authorities in December 2000, and covers the main structure in production license 090. Fram Vest is planned as a subsea development linked to Troll C, with gas injection as the drive mechanism. The plan is to tie the remaining reserves in Fram to Troll C as processing capacity becomes available. In 2000, it was decided that a new exploration well would be drilled in production license 153. The results from the well will determine the further development plans for Gjøa. A technical study in 2000 concluded that the gas reserves in production license 248 cannot be phased in to Visund. A tie-in to Kvitebjørn or Troll is being considered.

The Tampen area lies in the northwestern part of the North Sea, and consists of a number of large oil fields that have been in operation for a long period of time. These fields are Statfjord, Snorre, Gullfaks and Visund. Several smaller fields are linked to the main fields and contribute to exploitation of the process capacity in the area. There are also several discoveries that will be developed in the next few years, in addition to potential resources in smaller, undrilled structures between the fields. A common factor for all of the fields is that the reservoirs consist of sandstone from the Jurassic or Triassic Age.

Nine integrated living quarters, drilling and process installations are in operation on Tampen, while two are under construction. 32 subsea templates are connected to the various installations by pipelines. The Tampen installations constitute the largest concentration of infrastructure on the Norwegian shelf. The volume of remaining oil and gas in the area's reservoirs can sustain production for 20 years. Unitization and streamlining of the infrastructure will be a particular challenge in the years to come. The lifetime of the oldest installations is limited, while they are currently the junction for processing and transport out of the area. A reorganization of the ownership structure in the Tampen area is currently being evaluated.

The Statfjord area has the following five fields in production; Statfjord, Statfjord Øst, Statfjord Nord, Sygna and Murchison.

The Statfjord area is now in a decline phase. One of the challenges in the years to come is to produce the remaining reserves in the fields. Extensive use of gas injection on the main field and continuous drilling of new wells will be important instruments to increase recovery. The Statfjord field also contains considerable gas after many years of gas injection. Evaluation is currently underway regarding how and when this gas can be produced.

The **Statfjord field** has been developed with three fully integrated installations with substructure and storage cells in concrete. The three satellite fields, Statfjord Øst, Statfjord Nord and Sygna are developed with subsea installations linked to the Statfjord C installation. Production from the satellite fields contributes to good exploitation of the process facilities on Statfjord C. Stabilized oil is stored in storage cells on each installation and offloading of oil takes place via one of the three oil loading systems on the field. Much of the produced gas is injected on the main field to improve recovery. The rest of the gas is transported through the Statpipe pipeline to Emden, while NGL is removed at Kårstø.

The north flank of the Statfjord field was developed with subsea installations tied to Statfjord C, and commenced production in 1999. The production from the north flank has, however, been disappointing due to low productivity and high water production. Therefore, the reserves estimate for the north flank has been reduced drastically.

Sygna started producing in August 2000 with two production wells and one water injector. The wellstream is sent to Statfjord C for processing and shipping.

The Murchison field is a British field that extends over the boundary to the Norwegian shelf. The produced oil is sent via pipeline to Shetland. The production level is maintained through water injection and high drilling activity. In order to further extend the field's lifetime, consideration is being given to developing several smaller discoveries in the area.

The **Snorre area** has the following five fields in production; Snorre, Vigdis, Tordis, Tordis Øst and Borg.

The southern part of the **Snorre field** has been developed with a floating tension leg installation in steel and a subsea template. The northern part of the Snorre field is under development and will be put into production during the summer of 2001. The installation on Snorre Nord is a semi-submersible production installation in steel. The oil from Snorre is transported to the Statfjord field for final processing. Most of the gas on Snorre is reinjected in the reservoir to increase oil production from the field. The Snorre reservoir has a complex structure with varying properties and many flow barriers. Several measures have been implemented in order to increase oil recovery on the field. Extensive use of WAG injection (water-alternat-

ing-gas-injection) has contributed to increased oil production. In addition, a large-scale pilot project with foam injection has yielded promising results. Increased use of this method is planned on Snorre.

The **Vigdis and Tordis fields** as well as **Tordis Øst** and **Borg** have been developed with subsea installations. Vigdis is connected to Snorre TLP, while Tordis is connected to Gullfaks C. Tordis Øst and Borg are both connected to the central manifold on Tordis. There are several small discoveries and prospects in the Vigdis and Tordis area that may be developed during the course of the next few years. They will probably be developed using existing subsea templates or through installation of new templates connected to the existing installations. This will contribute to continued high oil production from the area in the years to come.

The Gullfaks area

The installations on Gullfaks are an important part of the infrastructure in the Tampen area. In addition to treating the oil from Gullfaks, the installations are used for production from Tordis, Tordis Øst, Borg, Vigdis, Visund and Gullfaks Sør.

Other deposits in the Tampen area may also be relevant for development with tie-in to the Gullfaks installations.

Gullfaks has been developed with three Condeep-type installations with concrete substructures and steel frame topsides. All are fully-integrated process, drilling and living quarters installations, while Gullfaks B has a simplified process facility with only first stage separation. In recent years, Gullfaks A and C have been modified to receive and treat oil and gas from Gullfaks Sør.

Production from Gullfaks is in the decline phase and more than 80 per cent of the reserves have been produced. Production takes place with the aid of water and gas injection. The recovery rate on Gullfaks is expected to reach 55 per cent based on current plans. In addition, a considerable potential for increased recovery from Gullfaks has been identified, inter alia by locating and draining pockets of oil in water-flooded areas.

Gullfaks Sør consists of three deposits; Gullfaks Sør, Rimfaks and Gullveig, all of which have been developed using subsea templates linked to Gullfaks A and C. In Phase I, all produced gas is reinjected in Rimfaks and Gullfaks Sør. Phase II starts in 2001 and includes export of gas from the Gullfaks Sør deposit through a new pipeline to Statpipe.

So far, the production from the Gullfaks Sør deposit has shown a disappointing trend. The reservoir has proven to be structurally far more complex than previously assumed, and a substantial write-down of the oil reserves has been made in Phase I. One of the Gullfaks Sør wells will be drilled from Gullfaks A and represents the longest well path ever drilled by Statoil as operator.

The Visund area

Visund is located northeast of Gullfaks and contains oil and gas in several angled fault blocks. The development concept comprises a semi-submersible integrated living quarters, drilling and process installation in steel, and the oil is transported via pipeline to Gullfaks A for storage and shipping. The northern part of Visund is also being developed using a subsea solution. The field is produced with the aid of water injection and gas injection. All produced gas will be reinjected into the reservoir until a gas sales agreement has been realized.

The Kvitebjørn area

Kvitebjørn is a gas field with high pressure and high temperature. The plan for development and operation of Kvitebjørn was submitted to the authorities in December 1999 and approved by the Storting in June 2000. Gas deliveries from Kvitebjørn will start in 2004.

Kvitebjørn will be developed with an integrated, fixed production installation. The gas will be transported in a pipeline to Kollsnes, while the condensate will be transported in a pipeline connected to Troll Oljerør II for further transportation to Mongstad. The possibility of utilizing Kvitebjørn's condensate pipeline also for transport of oil from Gullfaks is being considered.

34/10-23 Gamma is a discovery located to the west of Kvitebjørn. Four exploration wells have been drilled, and three of these have proven gas. There are no development plans for this discovery, but the Kvitebjørn installation will be equipped to handle potential future gas production from 34/10-23 Gamma.

1.10.3 THE NORWEGIAN SEA

There are five fields in production in the area: Njord, Draugen, Åsgard, Heidrun and Norne, see Figure 1.10.3.

These fields account for about one-fourth of all Norwegian oil production.

The Norwegian Sea South

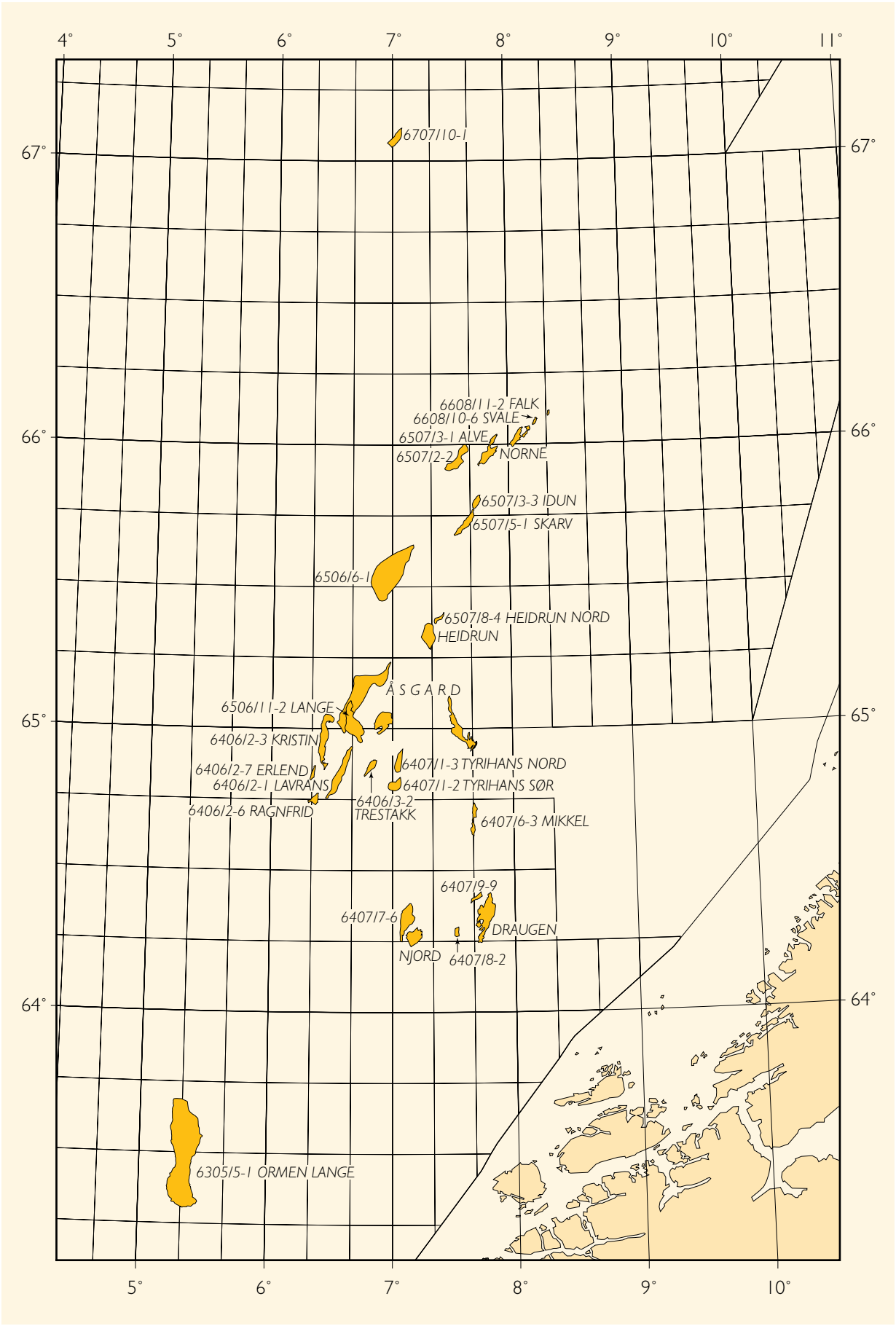
6406/2-3 Kristin is a gas/condensate discovery located to the southwest of Åsgard. Gas allocation has been sought for Kristin. The plan is to submit the plan for development and operation to the authorities in June 2001 with planned production start-up in 2005.

The intention is to use 6406/2-3 Kristin as a field centre in connection with the development of other discoveries and prospects in the area. The results of exploration wells in 2001 can affect the selection of development concept; semi-submersible installation with full processing or subsea development linked to Åsgard.

6407/6-3 Mikkel is a gas/condensate discovery located between Åsgard to the north and Draugen to the south.

The discovery was awarded gas allocation outside of the ordinary round in October, with planned gas sales in October 2003. The most likely development concept will be a subsea development tied in to Åsgard or Draugen. In addition to gas and condensate, there is also the possibility of recovering oil from a thin oil zone. Submission of a plan for development and operation is planned in May 2001.

Figure 1.10.3
Fields and discoveries in the Norwegian Sea



6407/1-2 Tyrihans Sør, **6407/1-3 Tyrihans Nord** and **6406/3-2 Trestakk** are other discoveries where the most interesting development solution is subsea connection to Åsgard.

The Åsgard field consists of three deposits: Smørbukk, Smørbukk Sør and Midgard, which are produced via subsea wells to two floating processing facilities, Åsgard A and Åsgard B. The gas pipeline Åsgard Transport and the storage vessel Åsgard C are tied in to the Åsgard B installation.

Oil production from Åsgard A started in the spring of 1999. Production has been marked by technical problems on Åsgard A, which has led to lower oil production than expected. Gas export from Åsgard B and gas export through Åsgard Transport to Kårstø was started in October 2000. Problems with the process facilities on Åsgard B resulted in the field not producing enough gas with satisfactory regularity. The gas export commitment has been fulfilled with the aid of production support from Troll, Oseberg and Gullfaks Sør. The Smørbukk wells in to Åsgard B were not opened for production in 2000, and this has led to lower liquid production from Åsgard B than expected. With the exception of the drilling programme, the Åsgard development is expected to be completed during the first quarter of 2001.

On the **Njord field**, two production wells were drilled to the Nord area during the course of the year, and these contributed to making production on the field higher than expected. Inclusion of these reserves was important, as the reserves estimates for the rest of the field were substantially reduced. Production is expected to come off plateau in early 2001. Various measures to increase recovery are being evaluated, including gas injection in the Nord area and new wells or sidetracks. Work is also underway to prove new discoveries and one exploration well has been drilled on the northwest flank so far. There are several prospects in this area. The first drilling period is concluded, and drilling will resume in 2002.

Gas export via Åsgard Transport started in November, delayed by a few weeks. Thus, injection of gas in the Husmus structure was concluded.

Early in the year, there was a rupture in the pipeline to the northern water injection template, which led to reduced pressure support in the northern part of the reservoir. However, the fault was repaired so quickly that it had little effect on production.

Two deposits with additional resources are planned for development on **Draugen**. One of these is Garn Vest, where two production wells will be drilled from a new subsea template linked to the Draugen production installation. Production from here is expected to start in the autumn of 2001. The other deposit is Rogn Sør, where there is already one production well that is not recovering the deposit optimally. Further development will comprise two production wells from a subsea installation with connection to the main installation on Draugen via Garn Vest. It is expected that the project will be approved in the spring of 2001, with production start-up in 2003.

It is expected that oil production will come off plateau in 2003 and that the volume of produced water will increase substantially during the period 2002-2007. Upgrading of the treatment facility for produced water has been approved by the licensees and will be installed in the autumn of 2001.

The Norwegian Sea North and deep water areas

In the area between Norne and Heidrun, several discoveries have been made, including 6507/2-2 Lysing and 6506/11-2 Lange, 6507/3-1 Alve, 6507/3-3 Idun, 6507/5-1 Skarv, 6507/5-1 Gråsel and 6507/5-3 Snadd. A small discovery has also been made just to the northwest of Heidrun in well 6507/7-13. Drilling was underway at year-end. The licensees are considering development of the discoveries individually and/or coordinated using the existing infrastructure in the area. The gas pipeline from Norne and Heidrun to Åsgard Transport is equipped for connection of a gas pipeline from a third party.

If the planned appraisal well on 6507/5-1 Skarv in the spring of 2001 proves sufficient resources in the structure, it may be possible to establish a dedicated field center on 6507/5-1 Skarv. An alternative development solution is a subsea development tied in to Heidrun. Gas allocation has been sought for 6507/5-1 Skarv.

The plan is to develop the 6608/10-6 Svale and the 6608/11-2 Falk discoveries to the northeast of the Norne field with subsea facilities linked to the Norne ship in 2003 and 2005 respectively. The plan for development and operation of Svale is expected to be submitted to the authorities in the autumn of 2001. The Norne ship also has the potential to phase in new discoveries.

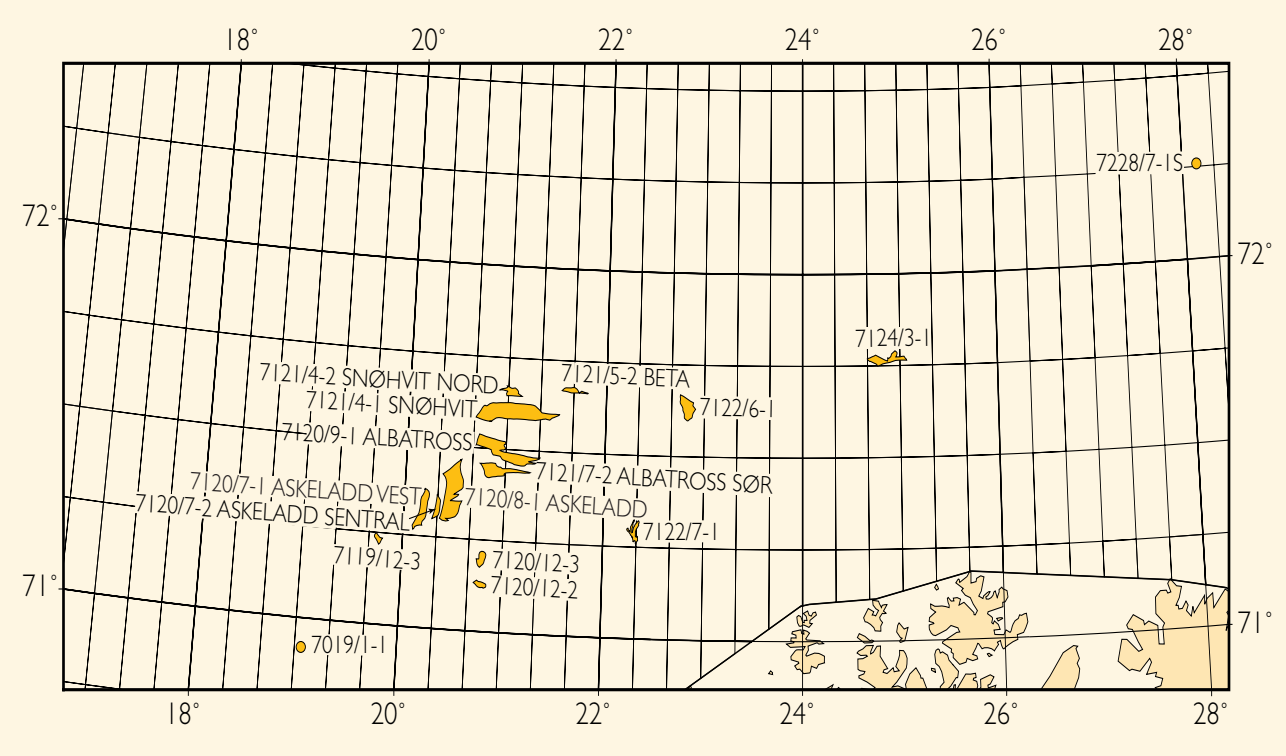
Several other major gas discoveries have been made in the Norwegian Sea, such as 6305/5-1 Ormen Lange and the 6506/6-1 discovery. The development of these discoveries assumes a larger market for gas, as well as development of new infrastructure for gas transportation. An appraisal was drilled in 2000 on the Ormen Lange discovery, and a new appraisal well is planned in 2001. The plan for development and operation may be submitted in 2002. The Ormen Lange development will be the first real deep water development on the Norwegian shelf.

The oil on the **Norne field** has been proven in sandstones from the Early and Middle Jurassic Ages. Oil production from the northeast segment started in June 2000. At the end of the year, the field was producing up to plateau. Plateau production depends on maintaining the reservoir pressure with the aid of water and gas injection.

A pilot project to evaluate increased oil recovery through the injection of bacteria and chemicals (AMIOR) in the reservoir was successful. The plan is to implement full field injection. Oil production on the Norne field is expected to come off plateau in 2003. In order to maintain plateau production for as long as possible, the operator has also intensified the work on proving and phasing in new discoveries in the area.

The Norne field has a gas cap in sandstones from the Middle Jurassic Age. Norne gas export did not get

Figure 1.10.4
Discoveries in the Barents Sea



underway in October 2000 as planned due to technical problems. It is expected that gas export from the field, which will take place via the pipelines to Åsgard Transport and on to Kårstø, will be in operation during the course of the first quarter of 2001.

Production on the **Heidrun field** is somewhat lower than the expected plateau, and is restricted by the gas treatment capacity due to gas breakthrough in several wells.

The development of Heidrun North Flank was completed in 2000. It consists of three subsea templates, two for production and one for injection. The subsea templates are linked to Heidrun TLP. Included in this development is the Heidrun Nord discovery which as from 1 January 2000 has been unitized with the Heidrun field. The Heidrun Nord plan for development and operation was approved in May 2000.

Gas export to Tjeldbergodden through Haltenpipe is proceeding as normal. The Heidrun field has secured gas allocation via Åsgard Transport as from 1 October 2000, but due to technical problems with laying the gas pipeline to Åsgard Transport, gas export will not start until in the first quarter of 2001.

Considerable exploration activity is still expected near Heidrun in the years to come.

1.10.4 THE BARENTS SEA

In the Barents Sea, most discoveries have been made in the area surrounding Snøhvit, see figure 1.10.4.

The Snøhvit area consists of production licenses 064, 077, 078, 097, 099, 100 and 110. The largest discoveries in the Snøhvit area include 7121/4-1 Snøhvit, 7120/8-1 Askeladd and 7120/9-1 Albatross. A unitization agreement among the licensees in the above-mentioned production licenses was approved by the authorities in July 2000.

The planned Snøhvit project includes development of the three discoveries 7121/4-1 Snøhvit, 7120/8-1 Askeladd and 7120/9-1 Albatross.

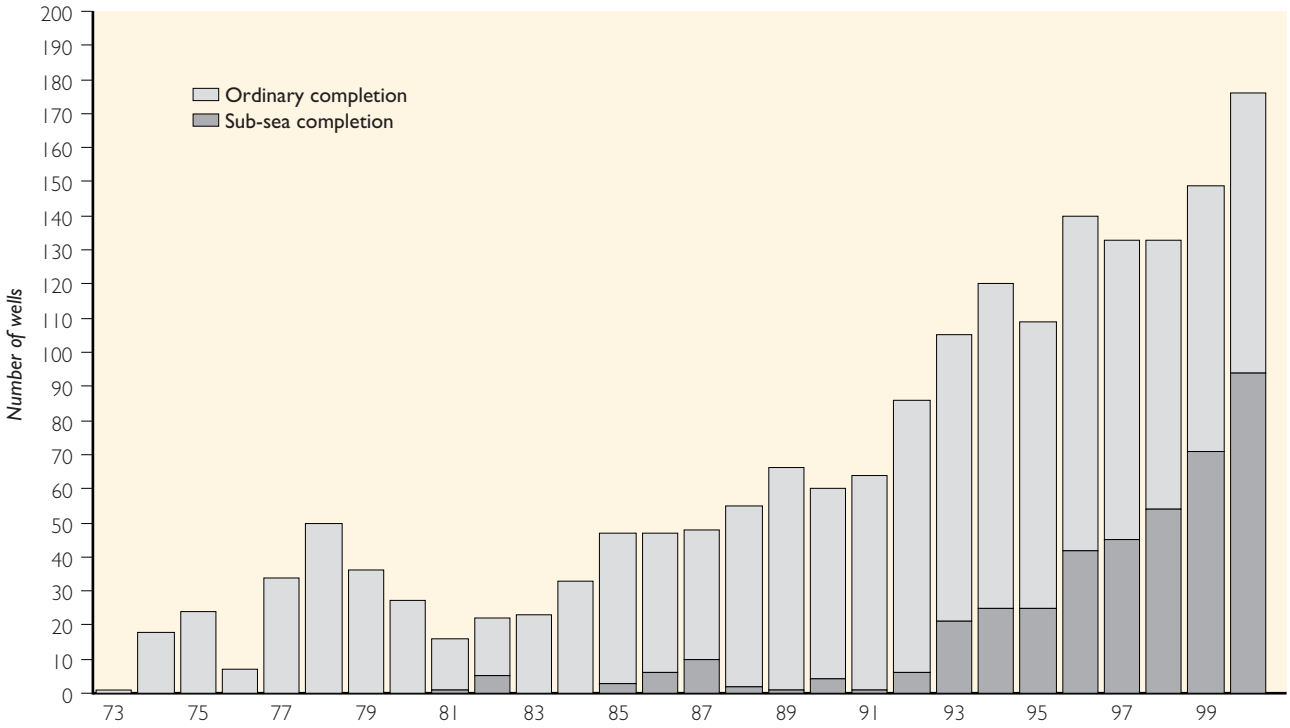
The operator's planned development concept is based on subsea installations where gas and condensate are sent in a multiphase pipeline to Melkøya, just outside of Hammerfest. On Melkøya, the gas will be processed and converted to liquid form (LNG), and sent to the market in specially-built ships.

Gas production is expected to start in 2006. There will be simultaneous production from Snøhvit and Askeladd, while Albatross will be phased in later. In addition, an injection well has been planned in the Snøhvit area for storage of CO_2.

Significant oil resources have also been proven in the Snøhvit discovery and work is proceeding on development solutions that can accommodate the requirement for profitable and flexible exploitation of these resources. A unitized development of the oil in Snøhvit and the 7122/7-1 discovery is being considered.

Development of the Snøhvit project will be the first step in the development of the Hammerfest basin. Establishment of infrastructure in the area will have a significant impact on possible future developments in the area.

Figure 1.10.5
Development wells on the Norwegian continental shelf 1973-2000



The licensees are preparing a plan for development and operation for submission around the summer of 2001.

1.10.5 DEVELOPMENT DRILLING

Since 1973, 1,828 development wells have been spudded on the Norwegian continental shelf; 1,678 of these in the North Sea and 150 in the Norwegian Sea. 1,329 are production wells, 316 inject water, gas or some other medium and 183 are observation wells. The wells have been drilled from 168 permanent installations.

Drilling was in progress on 19 development wells as of 31 December 2000. Figure 1.10.5 shows development wells spudded per year during the period 1973-2000.

As of 31 December 2000, production or injection is carried out from 105 installations divided among 55 fields. In 2000, 176 development wells were spudded on 32 fields; 140 in the North Sea and 36 in the Norwegian Sea. 93 of the wells, i.e. 53 per cent, were drilled from 20 different mobile units. The number of subsea-completed wells has shown a strong increase over the last nine years. This increase was particularly noticeable from 1995 to 2000 when the number of wells went up from 25 to 87. This means that the percentage of subsea-completed wells drilled per year has increased from seven per cent in to 49 per cent in 2000.

1.10.6 CESSATION PLANS

According to the Petroleum Act, the licensees shall submit a cessation plan 2-5 years before expiration of a production license or a license for installation and operation, or the use of an installation ceases. Cessation plans consist of a disposal section and an impact assessment section. Based on the plan, the authorities make decisions regarding disposal.

A Storting proposition on disposal of pipelines was submitted in 2000. In general, consent can be given to abandoning pipelines and cables assuming that they do not constitute an impediment or safety risk for bottom fishing, compared with the costs of trenching, covering or removal. This means that pipelines and cables can be abandoned when no significant bottom fishing occurs, or when they are abandoned in a properly trenched or covered condition. A precondition is that the pipelines and cables are cleaned and free of substances that can cause damage to marine life.

The Norwegian Petroleum Directorate is assisting the Ministry of Petroleum and Energy in formulation of guidelines for a cessation plan. The Norwegian Petroleum Directorate also contributes with assessments related to the cessation plans for the individual fields. Several cessation plans were considered in 2000; Ekofisk I, 2/4-G, Frøy, Yme and Varg. In addition, an updated plan for Tommeliten Gamma and a joint development and cessation plan for Glitne were considered. The cessation plan for Ekofisk is clearly the most comprehensive of these plans.

Ekofisk I

The cessation plan for installations in the Ekofisk area comprises the older installations on the Ekofisk field that were expected to become superfluous upon the transfer

Figure 1.11.1
Transportation systems for oil and gas from Norwegian fields

from Ekofisk I to Ekofisk II in 1998, as well as installations on outlying fields and other installations that are shut down. The outlying fields are Albuskjell, Cod, Edda and Vest Ekofisk. Two pumping installations on the British shelf, 36/22-A and 37/4-A, are also included. The plan covers a total of 15 major installations and 235 km of pipelines. Phillips Petroleum Company Norway is the operator of all the installations. With the exception of the Ekofisk tank, 2/4-T, all of the installations have steel jackets. Because consideration is being given to abandoning the Ekofisk tank, consultation with the authorities in other countries will be required in accordance with the OSPAR convention. In connection with the Ekofisk complex, two riser installations have also been shut down, one for Statpipe (2/4-S) and one for Valhall (2/4-G).

2/4-G
The plan comprises 2/4-G as well as the pipelines between Valhall and Ekofisk. 2/4-G is a riser installation for gas from Valhall. It was shut down in connection with the transfer to Ekofisk II. The installation is connected to the Ekofisk tank by means of a gangway, and BP Amoco is the operator.

Frøy
The cessation plan for Frøy comprises an unmanned wellhead installation in steel, a subsea installation that was used for pre-drilling of four wells and pipelines to the Frigg field. The pipelines constitute about 32 km, and consist of two production pipelines and one water injection pipeline. TotalFinaElf is the operator.

Yme
Yme has been developed with a jack-up production installation, a storage vessel and two subsea installations. The two subsea installations are linked with flexible pipelines, and further by production pipelines to the production installation. A flexible export pipeline runs between the storage vessel and the production installation. Statoil is the operator.

Varg
The cessation plan comprises a wellhead installation, subsea template, a production ship and about 1400 metres of flexible pipelines between the installation and the production ship. The installation is an unmanned wellhead installation in steel. Norsk Hydro is the operator.

Tommeliten Gamma
The cessation plan is an update of the original plan submitted in 1997. The update relates to factual information, the disposal plan itself is unchanged. The development consists of a subsea template with three 11.7 km long pipelines and two umbilicals to the Edda installation, as well as some equipment on this installation. Tommeliten Gamma was shut down in 1998. Statoil is the operator.

Glitne
As production from the field is expected to be of short duration, a joint development and cessation plan was submitted. The plan covers the production ship, storage vessel, riser, pipelines and umbilicals. Glitne has contracted production installations that can presumably used in some other location later on. Statoil is the operator.

1.11 TRANSPORTATION SYSTEMS FOR OIL AND GAS

1.11.1 EXISTING TRANSPORTATION SYSTEMS

The various transportation systems are shown in Figure 1.11.1.

Gas transportation
The transport capacity in any pipeline depends, among other things, on the composition of petroleum being transported, temperature and pressure. A change in any of these parameters will change the transport capacity. Therefore, the capacities listed below will change if the preconditions are changed.

Franpipe
Franpipe is an 840-kilometre pipeline with an outer diameter of 42" between Draupner E (16/11 E) and Dunkerque in France. The pipeline has an initial capacity of 15 billion Sm^3 per year. This can be increased by changing the pressure regime it operates under. Gas deliveries started in the autumn of 1998. Franpipe was previously called NorFra. The name change took place in the autumn of 1999. Statoil is the operator.

Frigg transport
The Frigg Norwegian pipeline (FNP) is owned by the Norwegian Frigg licensees. The gas from Frigg and the fields tied-in to Frigg is transported through the pipeline to the St. Fergus terminal in the U.K. FNP is 365 kilometres long and has an outer diameter of 32". The pipeline has a capacity of about 10 billion Sm^3 per year. Total Oil Marine UK is the technical operator.

Haltenpipe
Haltenpipe is a 245 kilometre pipeline with an outer diameter of 16" for transportation of gas from Heidrun to Tjeldbergodden. The pipeline has a capacity of 2-2.5 billion Sm^3 per year. The pipeline was put into operation in 1997. Statoil is the operator.

Europipe I
The pipeline runs from Draupner E (16/11 E) to Emden in Germany and is about 620 kilometres long with an outer diameter of 40". The capacity is approximately 13 billion Sm≈ gas per year. Gas deliveries started on 1 October 1995. Statoil is the operator.

Europipe II
Europipe II is a 662 kilometre pipeline with an outer diameter of 42" for transportation of gas from Kårstø to Dornum. The pipeline has a capacity of 21.7 billion Sm^3 per year and was put into operation on 1 October 1999. Statoil is the operator.

Norpipe gas pipeline
Norpipe transports natural gas from the Ekofisk Center to Emden in Germany and is owned by Norpipe A/S.

The gas pipeline is 442 kilometres long and has an outer diameter of 36". The design capacity is about 19 billion Sm^3 per year, assuming use of the two compressor stations on the German continental shelf. At the terminal in Emden, Norpipe is connected to Europipe so that gas from Norpipe can be delivered via the Europipe system and vice versa. Phillips Petroleum Company Norway is the technical operator of the pipeline, while Statoil is responsible for the financial and administrative functions.

Norsea Gas Terminal
Norsea Gas Terminal is the Norpipe gas receiving terminal in Emden. Phillips Petroleum Norsk AS is operator on behalf of the Phillips Group. The Norpipe system is connected to Europipe so that gas from Norpipe can be delivered via the Europipe system and vice versa.

Oseberg Gas Transport
Oseberg Gas Transport is a 108-kilometre pipeline with an outer diameter of 36" for transportation of gas from Oseberg to Statpipe via Heimdal. The pipeline has a capacity of about 13.3 billion Sm^3 per year and was put into operation on 1 October 2000. Norsk Hydro is the operator.

Statpipe
The Statpipe system comprises:

- a rich gas pipeline from the Statfjord area to Kårstø. The transportation capacity for the pipeline from Statfjord to Kårstø is 8.5-9 billion Sm≈ per year. The pipeline has an outer diameter of 30".
- separation and fractionating plant at Kårstø, plus storage and loading facility.
- a dry gas pipeline from Heimdal to the Draupner S riser installation with a length of 155 kilometres and an outer diameter of 36", a dry gas pipeline from Kårstø to Draupner S with a length of 228 kilometres and an outer diameter of 28", and a pipeline from Draupner S to the Ekofisk Bypass with a length of 188 kilometres and an outer diameter of 36".

Statoil is the operator for Statpipe, a 880-kilometre pipeline network with two riser installations and a gas processing terminal on Kårstø. The fields Statfjord, Gullfaks, Snorre, Brage, Tordis and Veslefrikk are tied in to the Statpipe system upstream of Kårstø. Rich gas is transported through Statpipe to Kårstø, where wet gas is separated and fractionated into products which then are transported with ships. Dry gas is transported in a pipeline to the riser installation Draupner S and then on to Emden via the Ekofisk Bypass and Norpipe. Heimdal is tied in to the Statpipe pipeline via a pipeline to the Draupner S riser installation. Sleipner is connected to Statpipe via a branch pipeline to Draupner. Statoil is the operator.

Kårstø
Delivery of dry gas from the gas processing terminal in Kårstø began on 1 October 1985. The facilities receive rich gas from the Statpipe system and condensate from Sleipner. The Kårstø facilities then consisted of two separation and fractionation/distillation lines for methane (dry gas), ethane, propane, butanes and naphtha, and one stabilization and fractionation line for condensate. The heavy hydrocarbons are removed from the wet gas and sold as propane, n-butane, methyl propane and naphtha. The condensate from Sleipner is split into propane, n-butane, methyl propane and condensate and shipped on to the customers. Propane, n-butane, methyl propane, naphtha and condensate are stored in separate tanks, prior to being pumped via fiscal metering equipment to tankers.

The first deliveries from Åsgard Transport came to Kårstø in 2000. Two new separation and fractionation/distillation lines have been built at Kårstø to treat the gas coming from Åsgard Transport. Storage has also been built for propane.

Dry gas is transported in the Statpipe pipeline from Kårstø to the riser installation Draupner S and then on to Emden in Germany. Europipe II started transportation of dry gas from Kårstø to Dornum in Germany in October 1999.

Zeepipe
Zeepipe is a gas transportation system which is to transport gas from Kollsnes in Øygarden to the Continent. Phase I of the project comprises an 800-kilometre pipeline with an outer diameter of 40" from Sleipner to Zeebrügge in Belgium. In addition, an approximately 40-kilometre line has been laid from Sleipner to Draupner S. Phase I, including the Zeebrügge terminal, was completed in 1993. The capacity without compression is about 12.6 billion Sm≈ per year.

Phase II comprises two pipelines from Kollsnes to Sleipner R and Draupner E respectively. The pipeline to Sleipner R, Phase II-A, was put into operation in 1996 and the pipeline to Draupner, Phase II-B, was put into operation in 1997. The capacity in Zeepipe II A and B is 17.2 and 18.5 billion Sm^3 per year respectively. Statoil is the operator.

Åsgard Transport
Åsgard Transport is a 745-kilometre pipeline with an outer diameter of 42" for transportation of gas from Åsgard and other fields on Haltenbanken to Kårstø. The pipeline has a capacity of about 20 billion Sm^3 per year and was put into operation on 1 October 2000. Statoil is the operator.

Oil transportation

Frostpipe
Frostpipe is an approximately 80-kilometre pipeline with an outer diameter of 16" for transportation of stabilized oil and condensate from Frigg and Oseberg. The transportation system has a capacity of about 16,000 Sm^3 per day. Production start was in the spring of 1994. Elf Petroleum Norge AS is the operator.

Norpipe oil pipeline
The pipeline system for transportation of oil from the Ekofisk Center to Teesside in England is owned by Norpipe Oil A/S. Norpipe receives oil from the fields in the Ekofisk area and the nearby Valhall, Hod, Ula and Gyda fields. Several British fields also use the transportation system.

Norpipe Oil A/S is a corporation owned 50/50 by Statoil and the Phillips group. Phillips Petroleum Company Norway is operator of the pipeline.

The ownership structure for the facilities at the Teesside terminal are split between Norpipe A/S and the Phillips group, through the Norpipe Petroleum UK Ltd. and Norsea Pipeline Ltd. companies. Phillips Petroleum Company UK Ltd. is the operator of the facilities.

Oseberg Transport System (OTS)
A pipeline for transportation of oil and condensate from Oseberg to the Sture terminal was laid in the summer of 1987. The pipeline has an outer diameter of 28" and has a design capacity of approximately 95,000 Sm^3 per day. By adding drag reducers, the capacity has been increased to about 117,000 Sm^3 per day.

The plant, including the terminal at Sture, is owned and operated by a separate joint venture, I/S Oseberg Transport System. OTS was put into operation when production started from Oseberg. Huldra, Veslefrikk, Brage, Frøy and Lille-Frigg have subsequently been connected to OTS via Oseberg. Norsk Hydro is the operator.

Sleipner condensate pipeline
The Sleipner condensate pipeline transports unstabilized condensate (condensate and NGL) from Sleipner Øst, Sleipner Vest, Loke and Gungne to Kårstø. The pipeline is about 250 kilometres long and has an outer diameter of 20". The capacity is up to 29,000 Sm^3 unstabilized condensate per day depending on the composition of the condensate. Statoil is the operator.

Troll Oljerør (Troll oil pipeline)
Troll Oljerør I and Troll Oljerør II transport oil from the Troll B and Troll C installations to Mongstad. Troll I is a 16" pipeline that was put into operation in the summer of 1995. Troll II is a 20" pipeline that was put into operation in the autumn of 1999. Statoil is the operator.

Ula oil transportation
Ula transport consists of the Ula pipeline and the Gyda pipeline. The pipelines transport oil and NGL from Ula and Gyda to Ekofisk for further transportation via Norpipe's oil pipeline to Teesside in the UK. The pipeline from Ula to Ekofisk is 70 kilometres long with a diameter of 20" and has been in operation since 1986. The pipeline from Gyda to the Ula pipeline is 25 kilometres long with a diameter of 20", and has been in operation since 1990. BP is the operator.

1.11.2 PLANNED TRANSPORTATION SYSTEMS

Grane gas pipeline
The Grane gas pipeline has been built to enable import of injection gas to the Grane field. The pipeline runs from the Heimdal riser installation to the Grane installation. The pipeline is 50 kilometres long and has a diameter of 18". Planned start-up is in 2003. The capacity will be approximately 3.5 billion Sm^3 per day. Norsk Hydro will be the operator.

Grane oil pipeline
The Grane oil pipeline connects Grane to the Sture terminal. The pipeline will initially transport oil from the Grane field, but it is possible that other discoveries in the area can also use the pipeline later on. The pipeline is 220 kilometres long and has a diameter of 29", which will give a transport capacity for the Grane oil of 40,000 Sm^3 per day. With an oil that is less heavy than the Grane oil, the pipeline capacity will increase. Planned start-up is in 2003. Norsk Hydro will be the operator.

Kvitebjørn gas transport
Kvitebjørn gas transport links the Kvitebjørn installation to Kollsnes, and will transport rich gas from Kvitebjørn to processing at Kollsnes. An approved plan for installation and operation entails a solution where the diameter of the pipeline is 26" and the length is 145 km. The operator is currently reevaluating this design, and it is likely that the diameter will be increased to 30", the transportation capacity will then be 8.5 billion Sm^3 per day. Planned start-up is in 2004. According to the plan, Statoil will be the operator.

Kvitebjørn oil pipeline
The Kvitebjørn oil pipeline will transport condensate from Kvitebjørn to Mongstad, via Troll Oljerør II (TOR II). KOR is linked to TOR II downstream of Troll, via the Fram/Gjøa Y connection, which is already installed on TOR II. A pipeline diameter of 16" is proposed in the plan for installation and operation (PIO). This is currently being reevaluated and may be increased to 20". The capacity in a 20" pipeline is in the order of 10-15 million Sm^3 per year. The highest capacity depends on the use of flow improvers and a low oil rate from Troll. Start-up is planned in 2004. According to the plan, Statoil will be the operator.

Vesterled
Vesterled comprises a new pipeline that is 45 km long and

has a diameter of 32", which, in combination with the existing Frigg transportation system (FNA) will enable the transportation of gas from Heimdal to St. Fergus in the U.K. The capacity will be 10-11 billion Sm^3/year. The new pipeline will run from the Heimdal riser installation to FNP. The entire pipeline system will consist of the existing FNP pipeline, the Norwegian part of the terminal at St. Fergus and 50 per cent of the joint facilities at the terminal in addition to the new connection. Gas transportation is expected to start in October 2001. According to the plan, Total Oil Marine UK will be the technical operator.

1.12 PROJECTS

1.12.1 COOPERATION PROJECTS

FORCE

FORCE ("Forum for Reservoir Characterization, Reservoir Engineering and Exploration Technology Co-operation") is a cooperation forum on problems related to exploration and improved oil recovery. FORCE started in 1995. In 1998, it was decided that the Forum would be continued until the end of 2001. In the autumn of 1999, it was decided that the FIND Cooperation Forum would be continued within FORCE.

There are now 19 members in FORCE, including the Norwegian Petroleum Directorate and the Research Council of Norway. All members are represented on the board, where Statoil holds the chairmanship. The secretariat is located in the Norwegian Petroleum Directorate.

The main goal of FORCE is to contribute to improving oil recovery on the Norwegian continental shelf. The potential for improved oil recovery is large and, to some extent, time-critical. FORCE is also a forum for collaboration on issues related to new technology associated with the exploration phase that may be relevant for the Norwegian shelf. FORCE provides the companies with a forum in which to discuss important issues with each other, with the authorities and with representatives from the research and supplier industries. In their respective organizations, the FORCE members have broad expertise and experience which provide a unique opportunity for solving problems together, or initiating cooperation projects with external suppliers. The participants in FORCE discuss and initiate research, development and demonstration of methods and tools which contribute to future improved oil recovery and improved exploration technology. FORCE has technical committees within basin and reservoir modeling, seismic methods, advanced wells and recovery processes.

In connection with the integration process between FORCE and FIND, the following new working groups were set up under the somewhat redefined Earth and Reservoir Modelling Committee:

- Sedimentology and Stratigraphy
- Visualization
- Uncertainty
- Reservoir characterization
- Multi (National Geodata Model)

There is already substantial activity in some of these groups. Several seminars and workshops are planned in 2001 and work is underway on concrete project proposals. An Executive Workshop was held in the summer of 2000 to discuss the future of FORCE and what could be done to stimulate new cooperation projects. At the board meeting in September, all of the participants were positive to continuing the FORCE cooperation beyond the three-year period that expires at the end of 2001.

In the autumn of 2000, a large seminar entitled "3D Volume Interpretation and Visualization" was organized. The attendance was record-high and there was also an opportunity to view demonstrations of the latest visualization technology.

A smaller workshop entitled "Downhole hydrate formation in combined water - gas injection" was also held. For more information on FORCE and the activity in the committees, please check the web site www.force.org.

FUN

FUN (*Forum for **F**orecasting and **Un**certainty Evaluation Related to Petroleum Production*) is a cooperation forum relating to problems within the areas of preparing prognoses and uncertainty evaluations for future oil and gas production. FUN was started in May 1997 and has 15 oil companies and the Norwegian Petroleum Directorate as members. The Ministry of Petroleum and Energy and OLF (Norwegian Oil Industry Association) are observers in the forum. The forum is organized with a board consisting of representatives from all of the members. The Norwegian Petroleum Directorate currently holds the chairmanship. The Norwegian Petroleum Directorate is also responsible for the secretariat.

The main objective of FUN is to develop better practice and methods with regard to estimating hydrocarbon resources, forecasting future production with associated emissions and discharges, uncertainty evaluations and decision processes. Two working groups have been set up. Working Group 1 is to focus on improved information and reporting routines among the companies and between the companies and the authorities. Working Group 1 shall also be the forum for changes in connection with reporting for the national budget. Working Group 2 is responsible inter alia for initiating and being a programme committee for workshops and seminars for managers and technical personnel. In addition, projects will be initiated through this working group. There are three networks under Working Group 2: "Production Forecasting", "Energy Balances and Emission Forecasting" and "Expenditure Forecasting and Decision Making".

In 2000, FUN has been used actively in connection with the national budget reporting in order to discuss reporting changes. The forum has also been used for feedback to and from the operators.

In 1999, FUN also initiated a project relating to best practice within the field of forecasting and decision-mak-

ing under uncertainty. The project is divided into three phases. The initial phase of the best practice project has consisted of mapping current practice in the companies and the authorities. The first phase was completed in the first of 2000. Twelve oil companies, the Ministry of Petroleum and Energy and the Norwegian Petroleum Directorate participate in the project. The companies' offices in Norway, as well as some of the headquarters of foreign companies were interviewed. In addition, the authorities in various countries were interviewed. Phase 2 of the project starts in 2001 with 13 oil companies in addition to the Norwegian Petroleum Directorate. In this part of the project, a teaching system will be developed in which focus is placed on making decisions under uncertainty from exploration to cessation of production. FUN organized the following seminars/workshops in 2000: "Challenges, Practices and Opportunities for Improvement", "Best Practice Workshop", "Expenditure forecasting and decision making", "Companies procedures of decision making".

For more information, check the web site (www.fun-oil.org).

SAMBA

In recent years, the Norwegian Petroleum Directorate has been in the forefront with regard to the use of databases and analysis tools. This has provided great advantages in connection with production of reports and analyses, and in the delivery of final reports with a high level of quality. The SAMBA project has been established in order for the Norwegian Petroleum Directorate to maintain the advantage of having good, quality-controlled databases based on modern IT technology in the future as well.

The SAMBA project was started with a pre-project in 1996. The first modules of the system were put into use in 1997. SAMBA consists of the following modules: Companies, production licenses, agreement-based areas, fields, field sections, discoveries, deposits, resource estimates for deposits, profile collections, transportation and exploitation facilities, parts of transportation and exploitation facilities, prospects and prospect estimates.

SAMBA entails a systematization and integration of information which provides the Norwegian Petroleum Directorate with a good overview of the activities on the Norwegian shelf. The project also emphasizes use of standards found in the market. POSC's (Petrotechnical Open Software Cooperation) Epicentre data model is used in the data modeling.

SAMBA is a key tool in connection with reporting for the national budget. The entire resource accounting is now found in the database. Provisions have been made which mean that the data is easily accessible both for ordinary end users and for advanced users who want to explore the database in more detail and assemble and analyze the data.

DISKOS

The DISKOS project started as a collaboration between Saga Petroleum, Norsk Hydro, Statoil and the Norwegian Petroleum Directorate in 1993 for development and operation of a common database (the DISKOS database) for technical petroleum data. The project now includes a total of 16 oil companies as well as the Norwegian Petroleum Directorate that are linked together in a high-speed electronic network. The DISKOS database includes most of the processed 2D and 3D seismic from the Norwegian shelf, in addition to all navigation and velocity data. The Diskos database also contains quality-controlled well data and production data.

Access to the data is governed through the rules and agreements for usage rights which the parties have entered into or which are stipulated in the Petroleum Act. A comprehensive access rights system in the DISKOS database prevents unauthorized end users from obtaining access to confidential data. The PetroBank® software is used to manage the data in the Diskos databases. PetroBank® was developed by IBM and subsequently PGS through the Diskos project. PetroBank® is POSC (Petrotechnical Open Software Corporation) compatible, an open solution that communicates with various end user technologies. The software is continuously upgraded with new functionality for all types of data. This development is financed in part by the Diskos group.

A major project was initiated in 2000 to load all historical well data from the Norwegian shelf into the database. Starting from 2000, production reporting was assigned to the Diskos database so that the oil companies now have the opportunity to gain direct access to reported data and share this with other Diskos members. The Norwegian Petroleum Directorate's internal database for production data (PPRS) has also been converted to the Diskos database.

The Norwegian Petroleum Directorate delivers quality-controlled administrative data to the database on a weekly basis. This data describes production licenses, blocks, fields, seismic navigation, well locations, pipelines, etc. and the database now contains more than 35 terabytes of data.

Other countries are very interested in the Norwegian DISKOS concept and the management has provided support for similar projects in several countries. Similar projects have been established in Brazil and the U.K.

The collaboration in the DISKOS group is headed by the Norwegian Petroleum Directorate. The costs of development and operation will be divided among the users of the system. The operation of the database itself has been outsourced to the company PetroData A/S.

1.12.2 PARTICIPATION IN RESEARCH AND TECHNOLOGY DEVELOPMENT PROGRAMMES

In 2000, the Norwegian Petroleum Directorate has been involved in several public research programmes and forums for technology development.

OG21

The Norwegian Petroleum Directorate has participated in

the work on developing a national technology strategy for increased creation of value and competitiveness in the oil and gas industry (Oil and Gas in the 21st Century). The daily work has been carried out by a core team on the basis of guidelines and input from a strategy panel. The study has gone on over a six-month period starting in August 2000 with representatives from oil companies, the supplier industry, Sintef, the Research Council of Norway and the Norwegian Petroleum Directorate. The assignment has been carried out on behalf of the Ministry of Petroleum and Energy.

Offshore 2010

Offshore 2010 is a research programme for user-controlled research and development in the petroleum sector. The programme is administered by the Industry and Energy Section (IE) in the Research Council of Norway (NFR). The Norwegian Petroleum Directorate is a member of the board of Offshore 2010.

Petroforsk

Petroforsk is a research programme for fundamental petroleum research. The programme is organized by the Science and Technology Section (NT) in the NFR. The Norwegian Petroleum Directorate is a member of the programme board of Petroforsk.

Petropol

Petropol is a research programme that addresses internationalization, change and new challenges for the Norwegian petroleum industry. The programme is administered by the Cultural and Social Section (KS) in the NFR. The Norwegian Petroleum Directorate is a member of the programme board of Petropol.

CORD

CORD is a forum where the oil industry and the research communities meet to discuss, define and initiate cost-effective production development through cooperation in R&D projects. The Research Council of Norway is responsible for administrative coordination of the programme and SINTEF has the secretariat. The Norwegian Petroleum Directorate is an observer on CORD's board of directors.

Center for Operations and Maintenance

The Center for Operations and Maintenance is a foundation that addresses development of expertise and R&D projects within operations and maintenance, both for the petroleum industry and for other industries. Stavanger College (HiS) is responsible for the technical aspects and the Norwegian Petroleum Directorate participates in the foundation's technical council. The Norwegian Petroleum Directorate participates on the technical council for the foundation.

DEMO 2000

Project-focused technological development within the petroleum sector was initiated by a grant from the Ministry of Petroleum and Energy in 1999. The Norwegian Petroleum Directorate is an observer on the DEMO 2000 board of directors.

Figure 1.12.1
Multi echo sounder coverage

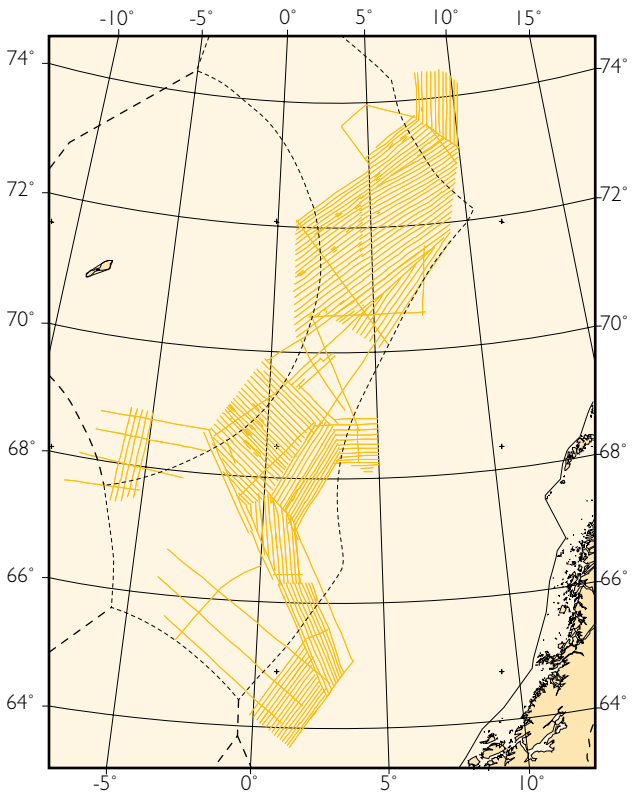
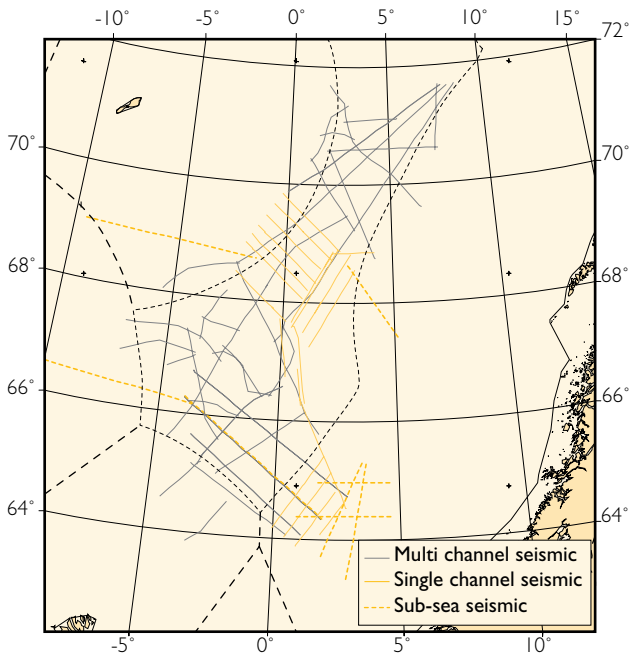


Figure 1.12.2
Seismic coverage



1.12.3 OTHER PROJECTS

The Norwegian Petroleum Directorate's mapping of the outer limits of the Norwegian continental shelf

The UN Convention on the Law of the Sea gives coastal states the right to draw up the limits of the continental shelf beyond the exclusive economic zone of 200 nautical miles. Norway ratified the convention in June 1996 and must submit information as regards the outer limits to the UN within 2006. The Ministry of Foreign Affairs is responsible for this work and, through the Ministry of Petroleum and Energy, has delegated the responsibility for the necessary technical studies to the Norwegian Petroleum Directorate.

In this context, acquisition and processing of bathymetric (water depth) and seismic data were carried out in the Norwegian Sea in 1999 and 2000, see Figures 1.12.1 and 1.12.2.

The bathymetric measurements were carried out with the aid of multi-ray echo sounders. A total of 210,000 square kilometres have been covered with such data, focused around the outermost parts of the Vøring plateau and the outer sections of a large sediment wedge to the southwest of the Barents Sea.

Several types of seismic data have been acquired:

During the acquisition of the bathymetric data in 1999, single channel 2D seismic was acquired along selected lines, totaling 1000 kilometres.

Multi-channel 2D seismic was acquired in 1999 (3,100 km) and 2000 (4,080 km). In 2000, the data acquisition was carried out in part in cooperation with institutions from Iceland and the Faroe Islands. This data acquisition is focused on the deep water areas in the Norwegian Sea, to the southwest and northwest of the Vøring plateau respectively.

In addition, regional seabed seismic (OBS) was acquired in 1999 and 2000 in the Norwegian Sea, totaling 1,900 line kilometres divided among 8 lines. The acquisition of this data was carried out in cooperation with Norsk Hydro and the Institute of Solid Earth Physics (the University of Bergen), which was the operator for the acquisition.

2. Safety and working environment administration

2.1 INTRODUCTION

The Norwegian Petroleum Directorate's performance of its administrative duties within the areas of safety, working environment, health and the external environment is based on a comprehensive administration model. The Norwegian Petroleum Directorate has been designated to play a coordinating role in relation to other public authorities that have independent supervisory responsibility in this area. Furthermore, the Directorate draws upon expert assistance from other departments in special technical areas and thus avoids building up duplicate expertise.

Administration of safety and the working environment is based on the principle of supervision of the industry's control over its own activities. This assumes that regulations are designed and supervision is implemented in a way that supports the participants' responsibility to carry out prudent operations in accordance with the formal framework for the petroleum activities.

Therefore, supervision of regulatory compliance is primarily aimed at management systems and decision processes that have significance for safety and the working environment. Through its supervision activities, the Norwegian Petroleum Directorate seeks to stimulate improvement processes in the companies, as well as to evaluate the companies' ability to manage their own activities in accordance with their own and the authorities' requirements.

The Norwegian Petroleum Directorate aims at providing continuity, systematism and a long-term perspective in the supervision of safety and working environment. In order to achieve this, the Directorate seeks to form an image of the development trends in this area over time, both in the industry as a whole and in the individual companies. In areas where the development is not as expected, the Norwegian Petroleum Directorate can then prioritize measures vis-à-vis the industry as a whole, towards the licensees in a production license, towards an individual operating company, or towards other participants. The Directorate also provides advice to the supervising ministries with regard to the overarching framework for the activities.

2.2 DELEGATIONS

The duties of the Norwegian Petroleum Directorate are set out in the special instructions of 1 October 1992. Duties have also been assigned to the Norwegian Petroleum Directorate by delegation of authority. Such authority is delegated either directly pursuant to acts/regulations or by individual delegation decisions by a superior authority. The delegations in the area of health, safety and the environment apply to:

a) The Petroleum Act of 29 November 1996, No. 72
   Including:
   The Safety Regulations, Royal Decree of 27 June 1997
   The Management Systems Regulations, Royal Decree of 27 June 1997
b) The Working Environment Act of 4 February 1977, No. 4
   Including:
   The Working Environment Regulations, Royal Decree of 27 November 1992
   Certain joint regulations for land and offshore issued with authority in the Working Environment Act
c) The Tobacco Act of 9 March 1973, No. 14
d) Regulations concerning safe practices in scientific research and exploration for petroleum deposits on Svalbard, Royal Decree of 25 March 1988.

2.3 THE RISK LEVEL ON THE NORWEGIAN SHELF

In recent years, the Norwegian Petroleum Directorate has noted a number of signals to the effect that the risk level in the offshore petroleum activities has been in a process of negative change. The previously positive trend seems to have turned.

As a responsible technical authority, the Norwegian Petroleum Directorate cannot allow such a potential trend to manifest itself in more serious accidents before adequate measures are implemented. At the same time, it is important that the measures are implemented where their effect will be the greatest in relation to the effort, also viewed in an overall social perspective.

It is no easy task to measure the risk level or to determine the direction in which it is developing. The overall risk is made up of a number of risk factors; from the risk of injuries to individuals to the risk of major accidents or catastrophes. For some of these, there are extensive statistics available that can be used as risk indicators. It may be tempting to place too much emphasis on such individual indicators because they are visible and measurable. Fortunately, the frequency of major accidents is very low and the statistics on such accidents are naturally not very reliable as indicators of the risk of such incidents.

In order to create a better foundation on which to make statements regarding the risk development on the shelf, the Norwegian Petroleum Directorate has initiated a project to establish a basis for measuring results in relation to the safety level in the petroleum activities.

The purpose of the project is to:

- maintain an overview of undesirable incidents, accidents, injuries and work-related diseases,
- measure the effect of the safety work in the petroleum activities,
- focus on the industry's own follow-up of trends and statistical analyses, with the intention that the industry will more easily be able to register what is happening with the risk level,
- contribute to identify areas that are critical for safety and where efforts to identify causes must be prioritized in order to prevent undesirable incidents and accidents,
- increase insight into potential causes of accidents and their relative impact on the risk scenario in order to

provide a basis for decisions by the industry and the authorities related to preventive safety and emergency preparedness planning.

The work can contribute to identifying potential commitment areas for regulatory changes, research and development. Furthermore, the Norwegian Petroleum Directorate will consider whether the project will lead to an annual activity, where an analysis of trends and risk level development is regularly prepared. The work in 2000 must be regarded as being a pilot project, with a somewhat more limited scope of work, and an objective that also included testing of the selected method.

The purpose of the pilot project has been to:
- develop a model, i.e. an analysis and evaluation process, that is designed to assess the development in the risk level on the Norwegian shelf,
- test the model using relevant data in order to identify necessary adaptations and adjustments,
- collect data that can be made available for 2000 in cooperation with the industry,
- produce the first annual analysis and evaluation report with data from the entire Norwegian shelf,
- identify changes that must be made for continuation in the form of annual analysis and evaluation reports, as well as prepare superior specifications for data tools.

The first report is expected in the first quarter of 2001. However, it has already been established that the risk level is rising.

2.4 SUPERVISION ACTIVITY

2.4.1 SCOPE OF THE SUPERVISION

The Norwegian Petroleum Directorate expends a considerable amount of its personnel resources on supervision of how the responsible companies look after their duties regarding regulatory requirements. This use of resources is subject to reimbursement from the companies that are the objects of such supervision according to the Regulations relating to refunding of expenses in connection with regulatory supervision of safety, working environment and resource management in the petroleum activities. The reimbursable supervision includes the Directorate's activities relating to:
- planning of the supervision
- processing applications for production licenses
- processing plans for development and operation (PDO) and plans for installation and operation (PIO)
- processing applications for consent
- system audits and verifications, incl. preparation and completion work, travel time, etc.
- participation in status meetings with the projects
- participation in committee meetings with the licensees
- follow-up of hazardous and accident situations
- emergency preparedness exercises
- processing reports relating to incidents, etc.
- processing applications for exemptions from the regulations
- individual decisions and other use of policy instruments
- meetings with relevant governmental departments
- management and administration

In 2000, the reimbursable part of the Directorate's supervision work amounted to 56,835 man-hours, compared with 51,202 hours in 1999. The increase is due, among other things, to the fact that the supervision in 1999 was somewhat reduced in connection with the resources expended on the work to revise the regulations relating to safety and working environment. Thus, the scope of the supervision activities in 2000 was once again approximately the same as the average for the five previous years. The supervision has largely been performed in accordance with the work plan for 2000.

2.4.2 PRIORITIZATIONS IN THE SUPERVISION

Each year, the Norwegian Petroleum Directorate prepares a plan for the supervision that it intends to carry out for the individual operating company and other participants in the activities. A number of factors affect the contents of the annual plan, such as:
- Prioritizations from superior ministries
- Accumulated experience from previous supervision
- Knowledge of accidents and incidents
- The companies' activity plans
- Input from other involved bodies
- Relevant development trends in the industry
- New or amended regulations

Prioritizations that affect the administration of safety and working environment are primarily developed by the Ministry of Local Government and Regional Development. In 2000, the Ministry asked the Norwegian Petroleum Directorate to prioritize efforts in the following areas:
- Overview and evaluation of safety level
- Supervision of mobile installations
- Supervision of the organizational change processes
- Supervision of the companies' maintenance of technical condition

The safety level

The prioritized area here has been aimed at mapping the causes of personal injuries, work-related diseases and other undesirable incidents, as well as to evaluate and implement follow-up measures in relation to these. The efforts have been aimed both at technical and organizational measures, and also include supervision of the participants own audit activities.

A main activity in this area has been the start-up of a project to measure the risk level in the petroleum activities and changes in this level. The project is addressed in more detail in chapter 2.3.

Mobile installations
Supervision under this area has, among other things, been aimed at factors related to the distribution of responsibility and tasks between operating companies, contractors and verifiers. In this context, the Norwegian Petroleum Directorate has inter alia been concerned with how the participants work together to achieve improvements in the technical condition of the installations. Supervision has also been carried out in respect of the quality of the evaluation processes the operator implements in connection with hiring mobile installations in its activities.

When selecting objects for supervision, the Directorate has prioritized installations where there are few registered deviations. This is based on experiences with regard to the quantity and type of deviations that are common for such installations, and the fact that a small number of deviations are often linked with a failure in the procedures for mapping and handling deviations. Deficiencies that the operating company has uncovered on the installations have also influenced the Directorate's selection of supervision objects.

The Directorate has also carried out supervision of shipowners and installations in connection with the implementation of the new system of acknowledgement of compliance (SUT). This system is described in Chapter 2.5.2 under "Regulatory framework", while the experiences from the supervision under the system are discussed in Chapter 2.4.3.

Organizational change processes
Prioritized tasks in this area have largely consisted of follow-up of experiences from previous years. The annual report for 1999 thus provides an extensive summary of problem areas and experiences linked to the ongoing organizational change processes in the industries, which have continued throughout the year 2000.

The supervision has been aimed at how the new organizations handle the challenges related to safety and working environment. A key area for the supervision has been the companies' capacity and expertise, e.g. in the implementation of necessary maintenance. The Directorate has also been concerned with how the interaction between the organizations on the installations functions in relation to the land organizations, in light of changes that the companies have implemented in this area.

Technical condition
As regards the technical condition of the installations, the Ministry has asked the Norwegian Petroleum Directorate to particularly follow up measures to prevent fire and explosion. Specifically, attention has primarily been aimed at process facilities and risers, as well as at activities and equipment related to drilling and well intervention.

The superior ministries also asked the Norwegian Petroleum Directorate to prioritize supervision aimed at dependable deliveries, which constitutes part of the overall safety concept. Elements that are included in dependable deliveries and that have been subject to supervision are

- Process and transport regularity
- Metering, monitoring and logging of produced and transported volumes
- Pressure class dividers in pipe systems
- Change in design conditions
- Preparedness related to reliable delivery

2.4.3 EXPERIENCES FROM THE SUPERVISION ACTIVITY

General
There has gradually been increased focus on goal achievment in the public administration, and thus in the cost/benefit value of the activities carried out by the administrative bodies. The goals the Norwegian Petroleum Directorate strives to achieve in its administration of safety and the working environment in the petroleum activities are long-term in nature. It has therefore proven difficult to evaluate the results achieved for a period of just one year.

The Norwegian Petroleum Directorate therefore initiated work in 2000 to make an overall evaluation of the development over the past 3-5 years with regard to the results achieved compared with the goals that the Directorate has stated for the administration of safety and the working environment. The Directorate's activities in 2000 represent a natural continuity in relation to the activities earlier in the five-year period, and support results that were previously reported during this period of time.

The results have provided the Norwegian Petroleum Directorate with a basis for gradually getting the industry itself to acknowledge that the developments in recent years have been unacceptable in terms of safety. It is the Directorate's opinion that the industry is now in the process of acknowledging the problems it is facing, and has started to implement measures to achieve real improvements. The Directorate believes that a breakthrough has been achieved in that there appears to be a reasonable degree of self-knowledge in the industry. This self-knowledge in itself

"West Navion" was issued the first acknowledgement of compliance from The Norwegian Petroleum Directorate

does not necessarily create better results, but it will form a good basis for actual measures that can create good results in the years to come.

The bulk of the Norwegian Petroleum Directorate's efforts in this period have been directed at the industry's control and achievement of goals in the areas of safety and working environment. The Directorate is of the opinion that the activities in the year 2000 have contributed to further acknowledgement and understanding of the fact that the underlying problems relate to management factors more than technical and operational issues.

As the management challenges in the industry have become more obvious through this period, the contour of the underlying challenge has emerged more distinctly. This challenge is expressed in the form of unfortunate aspects of the culture in the industry as a whole and in certain companies. This relates to aspects of a culture that is manifested through attitudes, understanding and actions that shape the individual's attitude towards safety. The Norwegian Petroleum Directorate believes that a basis has now been established that will allow the industry itself to acknowledge and do something about the unfortunate development in this area. This does not mean that the challenges are now solved, but rather that the Directorate sees new opportunities to achieve good results in the future.

Acknowledgement of compliance system - SUT

The Acknowledgement of Compliance system (SUT) entered into force on 1 August 2000, see a more detailed description of the system under Chapter 2.5, "Regulatory framework". Prior to this, the shipping industry had signaled great interest in applying for such acknowledgements of compliance and, in an understanding with the Norwegian Petroleum Directorate, the Norwegian Shipowners' Association set up a queue system for about twenty mobile drilling installations.

One acknowledgement of compliance was issued in 2000, for the mobile drilling rig "West Navion." According to the Norwegian Shipowners' Association's plan, several more applications should have been submitted and processed during the course of the autumn. However, the relevant shipowners experienced delays in the work of completing the applications. This meant that the Directorate received just two additional applications in 2000 for the drilling rigs "Deepsea Bergen" and "West Vanguard". These applications were being considered at the end of the year.

The Norwegian Petroleum Directorate perceives the delays as incorporating a positive element in relation to both improvements and attitudes regarding safety and working environment and the actual technical condition of the rigs. According to the Directorate's experience, which has to a certain extent been confirmed through the supervision activity, the shipowners' work to develop the applications has led to an acknowledgement that there were a number of needed upgrades, correction of non-conformities, etc. This work has taken more time than expected. The shipowners have thus incurred costs, but the Directorate still assumes that the system entails a significant potential for savings over time, because verification work, etc. will no longer have to be repeated for every new application of the rigs. The Norwegian Petroleum Directorate also believes that an improved safety and working environment standard over the long run will provide gains in itself.

2.5 REGULATORY FRAMEWORK

2.5.1 NEW REGULATIONS FOR THE HSE AREA IN THE PETROLEUM ACTIVITIES

In 2000, the Norwegian Petroleum Directorate, together with the Norwegian Pollution Control Authority and the Norwegian Board of Health, has nearly completed the comprehensive work associated with revising the regulations in the areas of health, safety and the environment. The work was started in 1997 with a point of departure that included a new Petroleum Act with associated regulations stipulated by Royal Decree which entered into force on 1 July 1997, as well as underlying regulations.

A decision has been made to the effect that the future underlying shelf regulations shall consist of four regulations for the following areas:

- management
- operations
- technology
- information

The four new regulations will be established and enforced by the three authorities jointly, and in accordance with the principles laid down in the system for coordinated supervision on the shelf.

The three-part regulatory forum "External Reference Group for Regulatory Development" (ERR) gave its general endorsement of the structure of the new regulations in 1998. Through ERR, the concerned parties are involved in the work of developing the contents of the four new regulations. The Norwegian Petroleum Directorate has had good experience with this from previous regulatory development efforts.

The goal of the revision work has not been more stringent requirements for the activities, but to continue the current regulation within the framework of a new regulatory structure. In the opinion of the Directorate, such a change will make the regulations more accessible, and will provide the supervisory authorities with more comprehensive and efficient control instruments. The purpose is also to facilitate a greater degree of utilization of recognized industry standards, increase predictability when applying the regulations to mobile installations, to provide a more comprehensive and multidisciplinary approach to various fields of responsibility, and to better adapt the regulations to the structure of the EEA regulations.

At the same time, work has continued on the draft for a new Royal Decree, or the so-called framework regulations,

which are to apply to this area. The working drafts were subject to internal consultation in the autumn of 1999. Simultaneously, the industry was also asked to comment on the drafts. The comments proved to be extensive and, in consultation with the Ministry of Local Government and Regional Development, it was decided that the deadline for submitting the documents to the Ministry with a request for approval to send the documents out for external consultation should be postponed until the end of January 2000. Therefore, the Directorate's work on the regulatory reform in 2000 has mainly consisted of processing the consultation comments and the final wording of the drafts based on such comments.

As a part of this work, there has also been continuous follow-up of relevant standardization work, in part through direct participation in the standardization work, and in part through formal consultation rounds. It is expected that the new regulations will be stipulated during the course of 2001, with a possible effective date around the end of 2001/beginning of 2002.

2.5.2 ACKNOWLEDGEMENT OF COMPLIANCE SYSTEM - SUT

In 1998, the Ministry of Local Government and Regional Development asked the Norwegian Petroleum Directorate to commence work on developing a system for a form of "advance statement" for mobile installations. The background for this initiative was inter alia a longstanding desire on the part of the shipping industry that such a system should be developed. It was subsequently decided that the system would be called "Acknowledgement of Compliance" (SUT).

The intention of the system is to contribute to providing the owners of mobile installations that have not entered into contracts for use on the Norwegian shelf with improved predictability concerning the installation's suitability in relation to the requirements of the legislation. Another goal is to streamline the work processes related to verifications and consideration of applications both in the industry and on the part of the authorities. The Norwegian Petroleum Directorate also expects a positive impact on the health, environment and safety management of mobile drilling rigs in that the system will contribute to placing the responsibility for such management more on the rig owner, where it belongs.

In order to develop such a system, a working group led by the Norwegian Petroleum Directorate was set up in the autumn of 1998. Other participants in the group are the Norwegian Shipowners' Association, the Norwegian Oil Industry Association, the Norwegian Confederation of Trade Unions, the Federation of Oil Workers' Trade Union, the Norwegian Maritime Directorate, Det norske Veritas, the Federation of Norwegian Engineering Industries and the Norwegian Licensees' Association.

The working group decided in 1999 that the system would be restricted to apply to mobile drilling rigs. However, the system will be subject to an evaluation after about two years. In this connection, it may also be relevant to consider a possible expansion of the system to also apply to other types of mobile installations.

The work of developing the technical evaluation basis for the shipowners' work on applications for such a statement was carried out by Det norske Veritas. In 2000, the Norwegian Petroleum Directorate has cooperated with the Norwegian Maritime Directorate to complete guidelines for applications for advance statements under this scheme. The system entered into force on 1 August 2000. One statement was issued under the new system during the course of the year. Experiences with the system are discussed in Chapter 2.4 - the Supervision activity.

2.6 INDUSTRIAL ACCIDENTS WITH PERSONAL INJURIES

The Norwegian Petroleum Directorate receives continuous reports regarding personal injuries that occur on installations involved in petroleum activities on the Norwegian shelf. Fatal accidents, serious personal injuries and other serious incidents shall be reported so that the Directorate can determine whether or not there is a need for immediate measures in each individual case. In addition to this immediate notification, all personal injuries that require medical treatment or which lead to absence during the following 12-hour shift, shall be reported to the Norwegian Petroleum Directorate using a special form. The form is also used to report industrial accidents to the National Insurance Administration. The information from these forms is recorded in the Directorate's register for personal injuries in the petroleum activities, and inter alia provides a basis for the Norwegian Petroleum Directorate's statistics. The main features are cited in the annual report while more detailed tables and figures are published on the Internet.

In 2000, the Norwegian Petroleum Directorate received reports of 777 personal injuries that occurred on installations in the petroleum activities on the Norwegian shelf. In addition, there were reports of 33 injuries classified as off-duty injuries and 49 classified as first aid injuries. The statistics include industrial accidents that

Figure 2.6.1
Personal injury frequency on permanently located installations

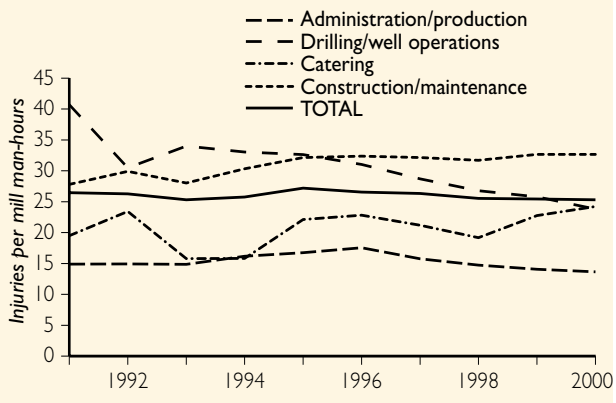
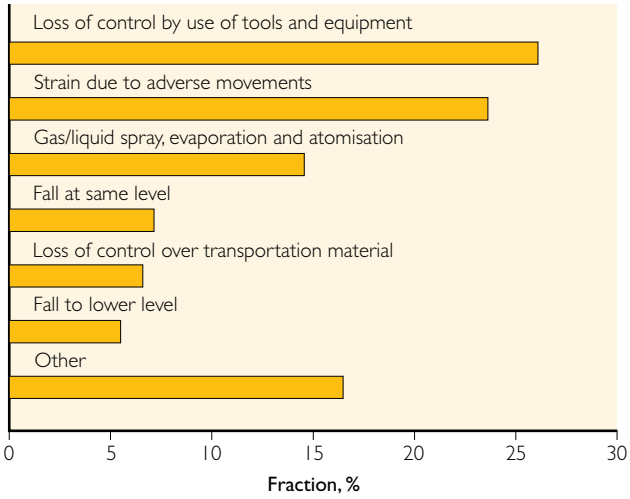


Figure 2.6.2
Cause of injuries for maintenance and construction on permanently located installations



fulfill the relevant criteria. First aid injuries and off-duty injuries are therefore not included in the basis for the figures in this chapter.

There was one fatality on the shelf in 2000. A person was killed in connection with cargo handling on the pipe deck after he was struck by the cargo so that he was crushed between the cargo and a container. The cargo consisted of seven tubing sections with a total weight of about two tonnes.

The Norwegian Petroleum Directorate's investigation of the accident led to observations that indicate that a culture has developed over time where breaches of fundamental principles for safe lifting operations are accepted. A contributing cause appears to have been confusion and varying perceptions of responsibility for activities in the relevant area of the installation. The accident, which occurred on 24 December 2000, is currently under police investigation.

In addition, a roughneck died on an anchor-handling vessel on 11 September 2000 of injuries he received when he was struck by a chain. This accident is being followed

Figure 2.6.3
Personal injury rate by operators and contractors on permanently located installations - 2000

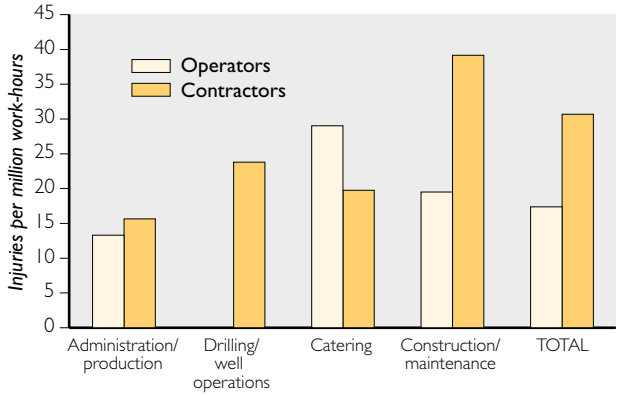
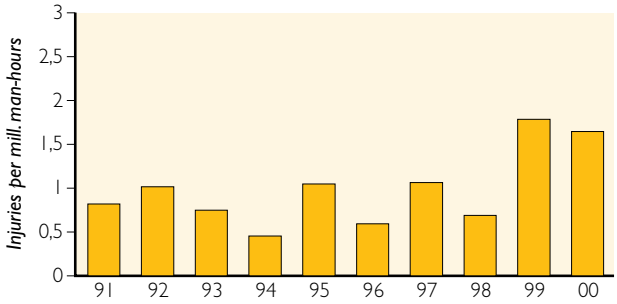


Figure 2.6.4
Serious personal injuries -
operator employees on permanently located installations



up by the maritime authorities, as it occurred on a vessel that is not subject to the authority of the Norwegian Petroleum Directorate. The accident is therefore not included in the statistics for injuries in the petroleum activities. The Directorate will nevertheless review the investigation report with a view towards potential measures across the various involved authorities' spheres of responsibility.

Figure 2.6.1 shows the injury frequency for the last ten years for injuries on permanent installations, as reported to the Norwegian Petroleum Directorate according to the criteria listed in the introduction. The figure also illustrates the injury frequencies for the various main activities on the installations. During the ten-year

Figure 2.6.5
Serious personal injuries -
contractor employees on permanently located installations

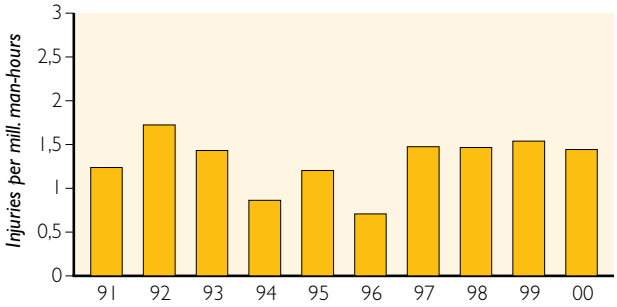


Figure 2.6.6
Personal injury frequency on mobile installations

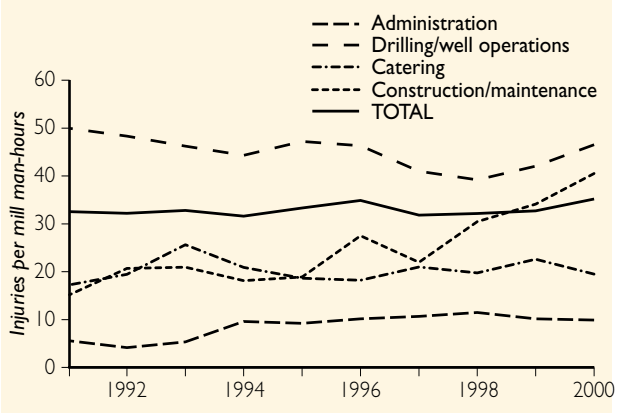
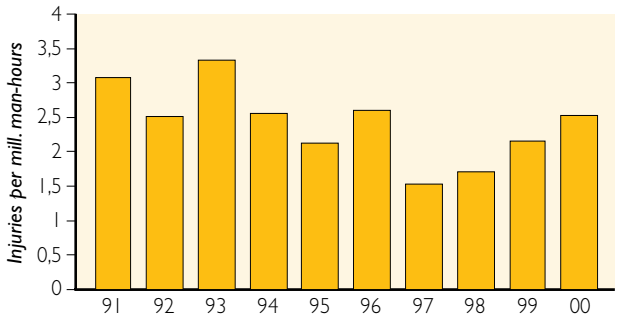


Figure 2.6.7
Serious personal injuries on mobile installations



period, there have been minor changes in the overall injury frequency, which has varied between 25.3 - 27.2 injuries per million man-hours. Since 1996, construction and maintenance activities have contributed most to the total injury frequency on the shelf.

Figure 2.6.2 shows the most important incidents that have led to personal injuries within the maintenance and construction group on permanent installations. The most important type of incidents is when the person who is injured or others in the immediate vicinity lose control over equipment or material that is being handled or transported. Together with various forms of strain to the body, this type of incident accounts for more than half of all incidents in this activity category. Pipelayers and mechanics are the most vulnerable occupational group.

Figure 2.6.3 shows that contractor employees on permanent installations are more vulnerable to injury than operator employees. However, operator employed catering personnel have been more exposed to injuries than contractor employees in this category in 2000.

On the other hand, if we look at injuries that are defined as serious, Figures 2.6.4 and 2.6.5 show that, in the last two years, there has been a marked increase in the injury frequency for operator employees. The increase is 80 and 66 per cent respectively compared with the average for the ten-year period. The average frequency of serious personal injuries during the ten-year period was 1.3 per million man-hours for contractor employees, while it was 1.0 for operator employees. However, in recent years, operator employees have had a higher frequency than contractor employees have had for the entire period since 1991.

Figure 2.6.6 shows the frequency of injuries within the main activities on mobile installations for the past ten years. In the same manner as for permanent installations, the overall injury frequency exhibits minor changes during the period. Nevertheless, there has been a significant increase in injury frequency within drilling/well operations and operations/maintenance as compared with the previous year. Even though the operations/maintenance group has exhibited a marked increase in injury frequency in the past three years, drilling and well operations are still the most vulnerable group on mobile installations.

Figure 2.6.7 shows the frequency of serious personal injuries on mobile installations during the period 1991-2000. The figure shows that the frequency has risen somewhat compared with the lowest values in the years 1997 and 1998. However, the changes are too small to provide a statistical basis for saying that the injury frequency is rising. The variations from year to year primarily reflect variations within the drilling category, which is also where most of the serious injuries occur. On mobile installations, the percentage of operator personnel is very small, which is why no figures are provided to differentiate the injury frequency between contractor and operator employees.

With regard to serious injuries, the mobile installations have a higher average frequency than the permanently located installations during the ten-year period. The average frequency was 1.2 and 2.4 serious personal injuries per million man-hours respectively. The development of the frequency through the period, however, shows a rising trend for permanent installations as compared with a falling trend for mobile installations.

2.7 WORK-RELATED DISEASES

The incidence of work-related diseases can provide information regarding the quality of the working environment. During recent years, the Norwegian Petroleum Directorate has worked towards the goal of having the companies use the collected information regarding causes and incidence of work-related diseases actively in their preventive safety and environmental work.

The Directorate received reports of 734 cases of work-related diseases in 2000. Of these, 168 were operator employees and 566 were contractor employees. This is a 6.2 per cent increase in the number of reports from 1999, giving a notification frequency of 26.1 incidents per million man-hours. After a sharp increase in the number of

Figure 2.7.1.
Distribution of work-related diseases on diagnosis groups 1998-2000

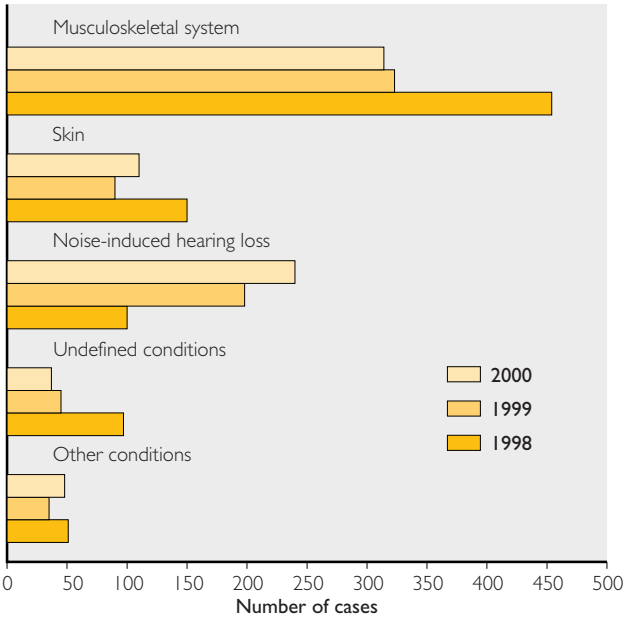
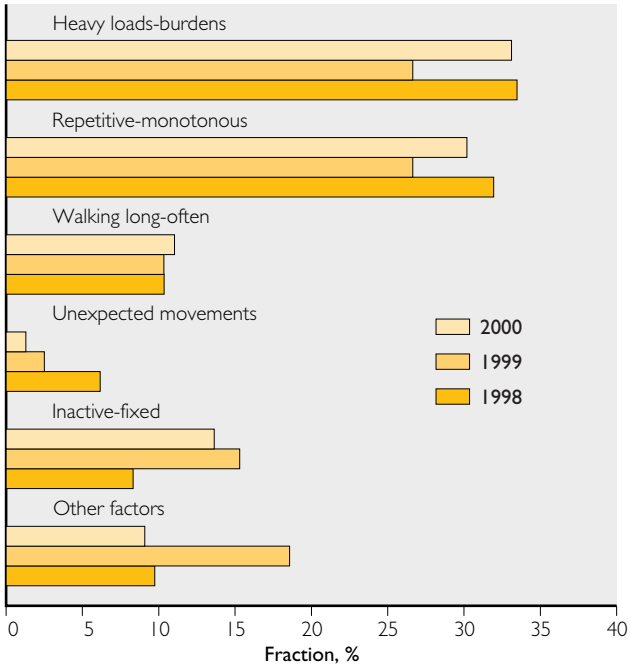


Figure 2.7.2.
Exposure factors - musculoskeletal conditions



reported incidents during the period 1992-1996, the number of cases in recent years has been fairly constant. The frequency increased a bit compared with the previous year; however, fluctuations of this magnitude must be expected without granting them too much weight. In order to contribute to the companies continuing to focus on work-related diseases, the Norwegian Petroleum Directorate carried out supervision aimed at reporting and further follow-up of new cases, both for operating companies and contractors in 2000. The purpose of this work was, among other things, to achieve a more uniform reporting practice on the part of the companies. The supervision was carried out in that the operators audited their own and the contractors' systems in this area. The Norwegian Petroleum Directorate has not yet completed its summary of this work.

If we disregard hearing injuries due to noise (230 cases), the frequency of other diseases is 17.9 cases per million man-hours. This is considerably higher than what has been reported for land-based industry.

There may nevertheless still be a certain amount of under-reporting, as there are still few reports received from some companies that have many employees on the shelf.

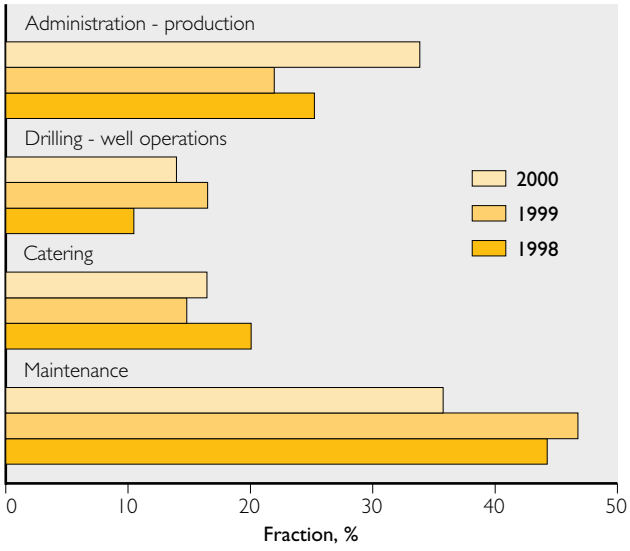
Last year, the presentation of work-related diseases in the annual report was changed in order to better present the main features of the material, and to achieve a clear concurrence with injuries and work activity. Figure 2.7.1 shows the distribution of some of the main groups of work-related diseases registered in the period 1998-2000. As previously, noise-induced hearing loss has been included and split out as a separate group. This is because the reporting requirement for this type of disease was changed in 1997, in accordance with the regulations of the Directorate of Labour Inspection. While these incidents were previously to be reported in summary, they must now be reported individually. This will provide a better opportunity to follow up individual incidents. Even though there is a significant increase in reported incidents of noise-induced hearing loss, from 100 in 1998 to 240 last year, there is still some uncertainty as to whether all new cases have been reported.

As previously, the picture is dominated by muscular and skeletal disorders (including disorders of the connective tissues). These types of disorders are normally referred to as repetitive strain injuries. They include back disorders, tendinitis and various forms of muscular pain. There was an insignificant decrease in the number of such incidents compared with the previous year, but the proportion of reported incidents fell from 54 per cent in 1998 to 43 per cent in 2000. In spite of this decrease, the figures remain high, and show that it is important to direct efforts towards preventive work in relation to these types of ailments. Not surprisingly, the stated causes of the cases in this group are largely manual labor within the areas of drilling, maintenance and catering.

The exposures which are listed as the causes of these repetitive strain injuries are summarized in Figure 2.7.2. This figure includes data for the last three years.

The figure shows that handling of heavy loads and heavy lifts were listed as one of the two most important causes of diseases in the muscular and skeletal systems in 2000, as in the two previous years. Another important cause of this type of ailments was repetitive monotonous work. Both heavy work and repetitive monotonous work are listed as causes of inter alia tendinitis and muscle pain. The proportion of cases of degenerative changes in knees and hips attributed to extensive walking on hard surfaces is relatively high, but basically unchanged compared with the previous year. Heavy lifts, sudden movements and inactive/sedentary work can result in back ailments in the form of lumbago/sciatica, however the percentage of this type of working

Figure 2.7.3.
Distribution of work related diseases on work categories



environment factor as the cause of back ailments has been significantly reduced compared with the previous year. Difficult access, which means that work must be performed in a crawling position or while kneeling, is another frequent cause of various knee ailments. This category is included in the group "Other" and, among other things, constitutes an important reason for the increase observed from 1998 to 1999. For 2000, the percentage of cases attributed to crawling/kneeling work returned to the same level as for 1998.

Skin ailments constitute another large diagnosis group. The number and percentage of cases in this group increased somewhat compared with the previous year. Slightly more than half (52 per cent) of the cases relate to eczema on the hands after contact with oil-based drilling mud. Some cases can also be attributed to other organic compounds, while epoxy is listed as the cause of 13 cases of contact eczema (up from four cases the year before) and one case of general allergic reaction. This is a significant increase in the number of cases, which illustrates that the preventive work in this area is still not good enough. As in 1999, there were no reports in 2000 of isocyanates as the cause of eczema, while four such cases were reported in 1998. Other cases in this group are presumably caused by inorganic compounds such as various metals and well chemicals.

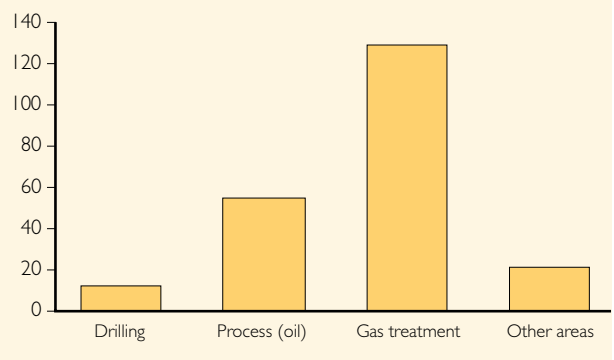
Undiagnosed conditions include various symptoms that are due to exposure to undesirable working environment factors, but which are difficult to classify as disease. These also include sleep disturbances. It seems obvious that many people experience sleep disturbances after having worked a so-called swing shift. This shift system was listed as the cause of 19 cases in 2000 as compared with 25 in 1999 and 71 cases in 1998. This reduction may be due to the fact that several companies have discontinued the swing shift system.

The group "Other" includes diseases that do not fall under the categories mentioned above. This group includes inter alia diseases of the respiratory organs such as asthma and bronchitis, and cases of respiratory irritation caused by airborne irritants such as oil vapor and smoke from welding. Three cases of asbestos-related lung disease have also been reported. In two of these cases, the exposure had led to lung cancer, and in one case to changes in the lung x-ray. These are employees who have been exposed in previous work, particularly on ships, and who have now developed asbestos-specific changes in the lung membrane.

Last year, one case of illness was reported listing isocyanates as cause; this related to a skin ailment. This is a reduction compared with 1999, when such exposure allegedly led to two cases of bronchial asthma, and one case of respiratory symptoms. The fact that cases of disease have been reported after exposure to isocyanates shows that continued preventive efforts are also required in this area. The fluctuations in the reported cases in this category (one case in 2000, three in 1999 and nine in 1998) may be due to the fact that preventive work has had an effect. However, it may also be due to varying attention surrounding these types of substances in recent years.

The various position categories that were exposed to work-related diseases are shown in Figure 2.7.3. Workers within the drilling sector have normally been perceived as being particularly vulnerable. However, taking into account that this function performed 26.2 per cent of the total man-hours, the percentage of cases is considerably lower than would be expected. This percentage is basically unchanged compared with the previous year, but did rise from 10 per cent in 1998 to more than 15 per cent in 1999. The proportion of reports for the catering staff is traditionally high compared with the number of man-hours worked. This was also the case in 2000 when the percentage was 16.4, while the percentage of man-hours for this group was 9.5. In 2000, the number of reported incidents in the construction and maintenance group was somewhat lower than the previous year. This group was responsible for 40.6 per cent of the total man-hours, but accounted for 35.8 per cent of the reported incidents of disease, and is thus as expected in relation to the number of hours of exposure. The percentage of cases in administration and production rose significantly from 21.9 per cent in 1999 to 33.8 per cent in 2000. Administration and production are thus disproportionately represented compared with the work volume of 23.7 per cent of the total man-hours worked. This may be due to the fact that a significantly higher number of cases of noise-induced hearing loss were reported for this group.

Figure 2.8.1
Area where hydrocarbon leaks occurred



Drilling:	Areas for drilling and well activities
Process (oil):	Areas for systems containing oil (wells, separators, etc)
Gas treatment:	Areas for systems normally containing gas only (compression, gas treatment, flare, etc)

2.8 HYDROCARBON LEAKS, FIRES AND NEAR-FIRES

2.8.1 HYDROCARBON LEAKS

Table 2.8.1 provides an overview of the reported hydrocarbon leaks over the past five years. None of the leaks are characterized as major, but there has been an increase in the number of medium-sized leaks from 21 to 30. The assessment of severity includes the amount of the emission/discharge, potential danger and causal relations. In 2000, in addition to the 217 leaks registered in the table,

the Norwegian Petroleum Directorate also received reports of 90 incidents of hydrocarbon leaks that were considered to be insignificant. The total number of leaks reported in recent years has been stable, with a falling trend for major leaks. With the exception of the year 2000, there has also been a decline in the number of medium-sized leaks. When compared with the production volume on the Norwegian shelf, the number and seriousness of the leaks is relatively stable.

Table 2.8.1
Hydrocarbon leaks during the period from 1996-2000, distributed according to severity

Year	Small	Medium	Large	Total
1996	120	32	4	156
1997	156	27	3	186
1998	128	26	3	157
1999	142	21	2	165
2000	187	30		217

Table 2.8.2 shows that minor leaks, such as from valves and couplings, are not usually detected automatically. Reporting and follow-up of such incidents are, however, of great value in the work to identify problem areas and causal relations. The reports show that the actual or underlying causes of a large portion of the leaks are related to lack of maintenance on equipment, or that systems and equipment are started up without faults being registered. A consistent trend relates to reports on leaks from flanges or valves that are handed over from project to operations without the necessary equipment inspection being carried out.

The Norwegian Petroleum Directorate has also noted that the operating companies' reports have concluded in several cases that the leaks were so large that they should have been detected by automatic detection systems. This indicates that the need for detection systems is still a critical factor.

2.8.2 FIRES AND NEAR-FIRES

The last two years have shown an increase in the number of alarms and reported fires and near-fires compared with the previous years. Most of the incidents are minor events (near-fires) in which smoke, flames or overheating has been registered for a short period of time. Five fires have been classified as medium-sized due to duration, quantity of smoke and flames, or factors related to emergency preparedness. None of the incidents led to personal injuries. One-half (41) of the reported fires have been investigated.

Two of the five fires classified as medium-sized were the result of fires in electrical equipment. The fires entailed considerable smoke and losses amounting to millions of kroner due to damaged equipment and loss of production.

Table 2.8.2
Distribution of hydrocarbon leaks in 2000 according to severity and method of detection

Severity	Automatic detection	Manual detection
Medium	21	9
Small	74	113
Total	95	122

One incident occurred in connection with torch cutting inside a separator, where inadequate cleaning led to evaporation of liquid and subsequent ignition. This caused a shock wave inside the tank where two people were working. One of the other two medium-sized fires occurred in connection with welding, and the other in connection with the ignition of diesel leakage on the hot surfaces of a motor.

Table 2.8.3
Fires and near-fires 1996 -2000

Year	Small	Medium	Large	Total
1996	15	3	1	19
1997	22	2	1	25
1998	17	4	1	22
1999	38	4		42
2000	75	5		80

Table 2.8.4
Causes of fires in 2000 distributed by size

Ignition source	Small	Medium	Total
Welding	7	1	8
Torch cutting	7	1	8
Electrical	30	2	32
High temperature	30	1	31
Other	1		1
Total	75	5	80

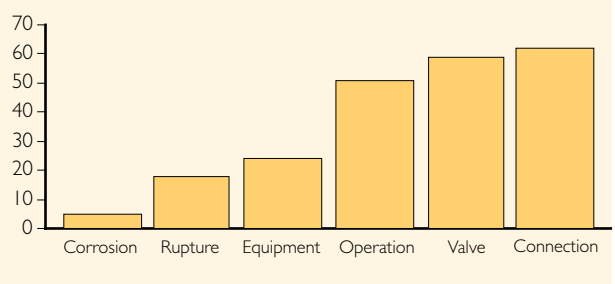
The most common causes of ignition in 2000 were electrical fires and high temperature on equipment.

The electrical fires were caused by factors such as:
- short circuits in cables, junction boxes or switchboards
- faults in electrical equipment (batteries, frequency transformers, transformers and electrical motors)

The reports received can indicate that the actual or underlying causes of fires in electrical equipment are lack of maintenance or design defects/weaknesses.

Ignition on hot surfaces has occurred in connection with:
- rotating equipment (bearings, etc.)
- turbines
- hot surfaces
- galley/washing equipment

Figure 2.8.2
Main group of faults resulting in gas leaks



Operation:	Faulty operation, inadequate procedures or planning
Connection:	Deficiencies in flanges or connections
Equipment:	Deficiencies in equipment or instruments
Rupture:	Cracks or fractures

The comparable actual or underlying causes of fires on hot surfaces are equipment maintenance and faults in connection with planning and carrying out a job. A typical incident in this context is that combustible material is left on hot surfaces.

2.9 DAMAGE TO LOAD-BEARING STRUCTURES AND PIPELINES

The Norwegian Petroleum Directorate receives reports of damage to and incidents involving load-bearing structures and pipeline systems. The information is gathered in the CODAM database. In 2000, there were reports of 15 incidents related to load-bearing structures and 20 related to pipeline systems. The database now contains data concerning a total of 3323 incidents related to load-bearing structures and 2286 incidents related to pipeline systems.

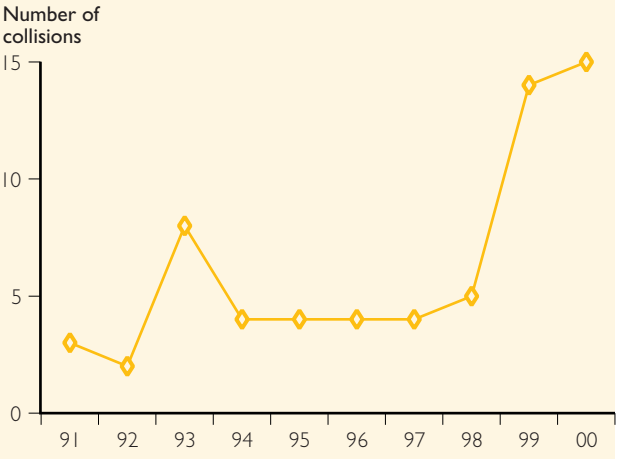
2.9.1 SUBSEA PIPELINES AND RISERS

Historically, the majority of reported injuries and incidents on pipeline systems are in the categories 'insignificant' and 'minor'. These are incidents that do not require much repair or follow-up. Incidents in the "major" category include, for example, leaks in pipelines and risers, incidents involving buckling of pipelines, as well as external and internal corrosion, etc., depending on the scope of the damage and the criticality.

In 2000, there were seven "major" incidents and damage involving pipelines and risers:

- fracture in a 12-inch flexible pipeline for water injection. The location of the fracture was in the conductor just below the coupling point on the pipeline. It was caused by nearly 200 metres of the riser being found coiled on the seabed outside the conductor. The cause of the fracture was fatigue on inner plastic layers as a result of overpressure in the conductor. A new pipeline for water injection has been installed.
- Buckling of a 10-inch oil pipeline. In connection with inspection of the pipeline route after start-up, buckling of the pipeline was discovered in two locations along the route. The height of the buckled sections was 5.3 and 2.7 metres above the seabed, with associated free spans of 38 and 25 metres. So far, the cause of the incident has not been clarified. The buckled sections have been stabilized by building up gravel supports.
- Water penetration in the annulus for a 6-inch flexible gas injection riser. This has led to reduced lifetime for the pressure barrier and, for this reason, four risers were taken out of production and replaced in the previous year. In one case, the water penetration was due to damage in the external case on the riser. The cause of the other incidents has not been clarified.

Figure 2.9.3
Collisions between vessels and installations 1991-2000



2.9.2 LOAD-BEARING STRUCTURES

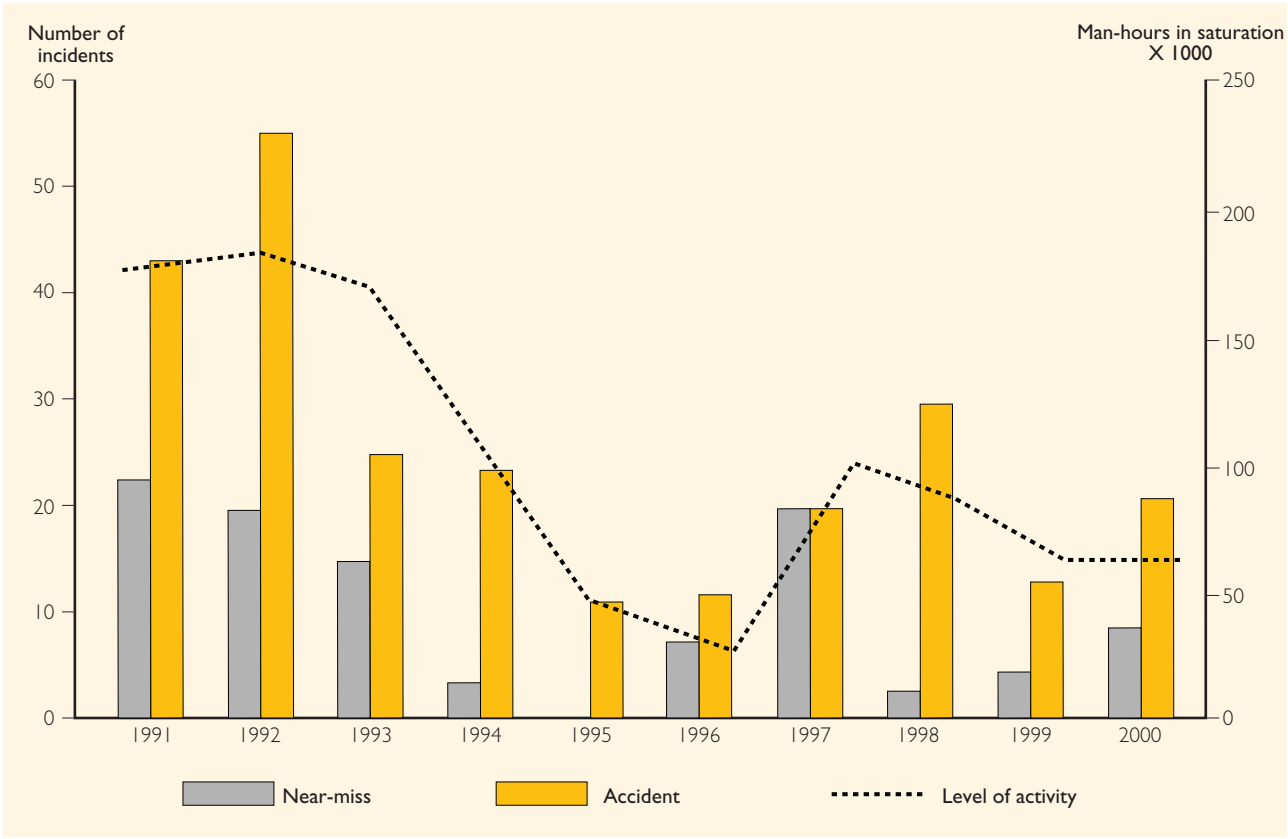
As for the pipeline systems, the bulk of the reported damage and incidents relate to load-bearing structures in the categories 'insignificant' and 'minor'. One incident was reported in 2000 that was classified as 'major':

- in connection with repositioning after a completed offloading operation, a tanker ran into the stern of a mobile production installation. The collision caused a crack in the installation's hull and damage to production equipment and the offloading hose. The damage has been repaired. The tanker suffered only minor damage to its bow.

2.9.3 COLLISION BETWEEN VESSELS AND INSTALLATIONS

Fifteen collisions between vessels and installations were reported in 2000, including the incident described above. This is the same level as in 1999, when the total number of collisions was 14. Mobile drilling rigs were involved in nine of the incidents, four incidents involved production installations while living quarters were involved in the remaining two incidents. Most of the incidents did not lead to significant damage to the installation or the vessel. In two cases, however, damage was reported on an installation and a vessel, a dent of about 3.5 x 4.5 metres with 30-cm indentation and a hole in the hull after collision with a jack-up drilling rig respectively.

Figure 2.10.1
Incidents in saturation diving



The Norwegian Petroleum Directorate has focused on the reporting of this type of incident, which has contributed to a marked increased in reported collisions in recent years. An average of five collisions per year have taken place during the period 1990 - 2000. Therefore, it is natural to assume that there has been a certain degree of under-reporting. A review of the causes of the collisions reveals that faults in, and incorrect operation of, positioning systems constitute the largest group of causes. The Norwegian Petroleum Directorate has appointed a group which, together with industry participants, will attempt to arrive at measures that can reverse this trend.

2.10 DIVING

2.10.1 DIVING ACTIVITY

During 2000, 21 surface-oriented dives and 329 bell runs totaling about 56,000 man-hours in saturation were carried out on the Norwegian shelf and in connection with Norwegian pipelines in foreign sectors. This represents a reduction in the scope of surface-oriented diving, while saturation diving remained at about the same level as in 1999.

The diving activities have been divided among inspection, maintenance and construction activities on fields where Hydro and Statoil are the operators. Diving in connection with construction work has constituted a large portion of the activity.

2.10.2 PERSONAL INJURIES IN CONNECTION WITH DIVING

Figure 2.10.1 presents a summary of the number of undesirable incidents reported to the Norwegian Petroleum Directorate in connection with diving activities over the past ten years. The incidents are subdivided into the categories near-miss, personal injuries and fatality. Personal injury is defined as an incident that requires medical treatment, first aid, or that entails absence extending into the next 12-hour shift. A near-miss is a dangerous situation which, under slightly altered circumstances, could have led to death or serious personal injury.

The figure shows that the number of reported personal injuries related to saturation diving in 2000 has increased compared with the previous year, where the activity level has been about the same. Of the 21 reported personal injuries in connection with saturation diving, none were of a serious nature. The majority of the personal injuries, 15 of 21, are related to infections.

Eight near-misses were reported in connection with saturation diving, of which one is characterized as serious. This incident involved an uncontrolled decompression of six divers from 14 metres to the surface during the course of about four hours. This could have led to serious decompression sickness and subsequent lasting injuries.

There have been a number of serious near-misses linked to underwater lifting operations in recent years.

2.10.3 EXPERIENCE GAINED FROM SUPERVISION OF THE DIVING ACTIVITIES

Through its supervision activities in 2000, the Norwegian Petroleum Directorate has noted cases of unsatisfactory attention to diving safety aspects, particularly in the planning and preparation of the diving operations. Several diving operations were stopped because key personnel on board had insufficient knowledge related to hyperbaric evacuation.

Training

No saturation divers were trained in Norway in 2000. During the course of the year, the Norwegian Professional Divers' School and the National Divers' School have trained a total of 86 divers who have been issued Class 1 certificates.

2.10.4 RESEARCH AND DEVELOPMENT IN THE AREA OF DIVING

In 2000, the Norwegian Petroleum Directorate has continued its participation as a member of the board and the project management group in a diving-related research programme, OMEGA. This involvement helps ensure that the Directorate's professional and technical staff is kept up-to-date with regard to ongoing R&D activities in this field.

In November 2000, the annual diving seminar was held as a joint seminar for both open sea diving and diving in sheltered waters.

2.10.5 INTERNATIONAL COOPERATION WITHIN DIVING

The Norwegian Petroleum Directorate is the chairman of the European Diving Technology Committee (EDTC).

2.11 LIFTING GEAR AND LIFTING OPERATIONS

A total of 68 undesirable incidents related to lifting operations were reported to the Norwegian Petroleum Directorate in 2000, compared with 52 in 1999. This figure includes all lifting operations, including lifting operations in connection with drilling. The number of incidents involving personal injury has gone down from 15 in 1999 to 9 in 2000. Again in 2000, one of the incidents led to the death of one person. Thus, both of the two fatal accidents that have occurred within the Directorate's sphere of authority in the last five years have been in connection with lifting operations.

The most important observations from the Norwegian Petroleum Directorate's supervision activities show that there are areas with clear potential for improvement in relation to lifting gear and lifting operations, which are largely the same as in the previous year.

- Operational procedures, as well as respect for and compliance with such procedures.
- Knowledge regarding safety and safety attitudes in connection with lifting operations.
- Use of experience from accidents and undesirable incidents in systematic improvement work.
- Involvement of technical and operational expertise in the operation and maintenance of lifting gear.

In 2000, the Norwegian Petroleum Directorate completed the project "Causal relations in connection with lifting operations". The project has collected and analyzed all internal company reports (also those reported to the Norwegian Petroleum Directorate) of undesirable incidents associated with the use of offshore cranes from all of the operators on the Norwegian shelf during the years 1994-1999. The analyses in the report cover 4,672 incidents. The results from the report will be used in the ongoing work to reduce the number of accidents and undesirable incidents associated with lifting operations.

On the basis of several serious incidents associated with the use of the personnel winch, all operators conducted a review of operational and technical status in this area in 2000. Such reviews have been performed on all installations that have and use this type of equipment.

At the end of 2000/beginning of 2001, a new crane simulator was put to use at the Ship Manoeuvering Simulator Center (SMS) in Trondheim. Statoil has played a key role in the development of this project, and the company is heavily committed on the user side. In the opinion of the Norwegian Petroleum Directorate, crane simulators used as a tool in developing and maintaining expertise will be an important element in future training within the crane discipline.

3. Environmental measures in the petroleum activities

3.1 CONSIDERATION FOR THE ENVIRONMENT

Consideration for the external environmental has attained a central position in the formulation of petroleum and energy policy. The external environment is safeguarded as an integral part of the work aimed at proper management of the Norwegian petroleum resources.

The main activities in this work are stipulation of regulations and other frameworks for the activities, preparation of reports and professional advice to the responsible ministries, and supervision of the activities on the shelf. Other activities are related to participation in national and international forums that work on external environmental issues.

A large portion of the work that is done out of consideration for the safety of personnel and financial assets also has a positive effect on the external environment.

3.2 MILJØSOK

MILJØSOK was established in 1995 in order to stimulate a more binding cooperation between the authorities and the oil and gas industry in order to solve the most important environmental challenges. The next phase of MILJØSOK started in 1997 when a secretariat was established in connection with OLF (the Norwegian Oil Industry Association), as well as a separate Council and Cooperation Forum. The Norwegian Petroleum Directorate participated in both the MILJØSOK Council and the Cooperation Forum, and in 1999 participated in several working groups established by MILJØSOK. In connection with Offshore Northern Seas (ONS) in the autumn of 2000, a final report entitled "Shared environment - shared commitment" was issued for MILJØSOK Phase 2. The report provides a description of environmental status and of the environmental challenges facing Norwegian petroleum activities. Furthermore, policy instruments, discharge/emission targets, industrial application of gas in Norway and the need for research and development related to the environmental aspect of the offshore activities, are being evaluated. Proposed measures are provided, as well as recommendations regarding future follow-up of MILJØSOK. The Norwegian Petroleum Directorate will also participate in the further follow-up.

3.3 AUTHORITIES AND FRAMEWORKS

The Norwegian Petroleum Directorate and the Norwegian Pollution Control Authority have the authority to supervise the petroleum activities under the Petroleum Act and the Pollution Act. The Norwegian Petroleum Directorate also enforces the Act concerning CO_2 tax on the shelf.

The Petroleum Act requires that all activities be carried out in a responsible manner which safeguards the safety of personnel, the environment and financial assets.

The Pollution Act has the objective of ensuring proper environmental quality so that pollution and waste do not lead to health hazards, do not affect general well-being or harm nature's capabilities of production and self-renewal.

The regulations regarding management systems, risk analyses and emergency preparedness have authority in both of the central acts mentioned above, and are administered by the Norwegian Petroleum Directorate together with the rest of the technology regulations and the Working Environment Act. Together with the Norwegian Pollution Control Authority and the Norwegian Board of Health, the Norwegian Petroleum Directorate has continued work on revision of regulations in areas which deal with safety, working environment, health and the external environment. This work is now in its final stages and the new regulations will be established and enforced by the three authorities jointly.

3.4 SUPERVISION OF THE ACTIVITIES

Security against pollution is also covered under the safety concept as it is applied in the shelf activities. Supervision of environmental measures and environmental activities is an integral part of the Norwegian Petroleum Directorate's supervision activities. In 2000, the Norwegian Petroleum Directorate, in cooperation with the Norwegian Pollution Control Authority, carried out one supervision audit that was specifically aimed at the operators' safeguarding of the external environment. The Norwegian Petroleum Directorate also carries out supervision of internal control systems for operators and contractors in order to ensure that the activities are planned and implemented in accordance with the authorities' requirements and goals and acceptance criteria in the companies.

The comprehensive integrity of the authorities' supervision work is ensured through the Norwegian Petroleum

Figure 3.1.1
Emission of CO_2 per Sm^3 o.e.

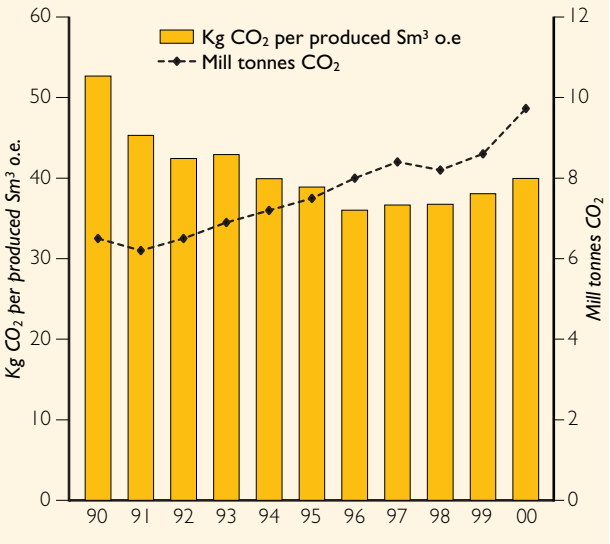
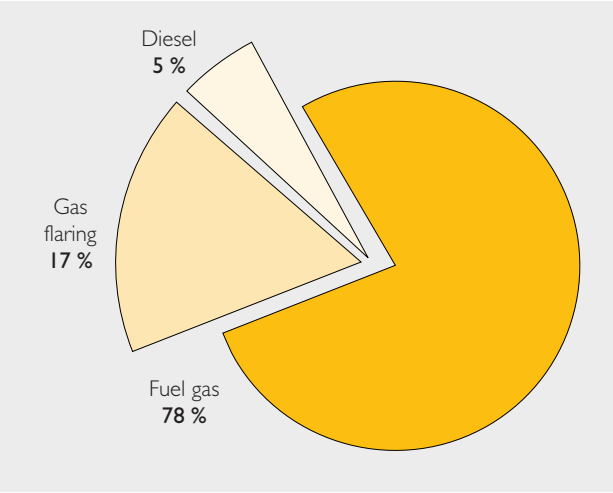


Figure 3.1.2
CO_2 emission sources 2000



Directorate's coordinating role in relation to the Norwegian Pollution Control Authority.

In its supervision of exploration drilling in environmentally sensitive areas, the Norwegian Petroleum Directorate has placed particular emphasis on preventive measures which the operators implement. In addition, the Directorate has followed the operators' work on stipulating acceptance criteria for environmental risk, in other words, the risk the operator itself can accept for its activity.

The Norwegian Petroleum Directorate also carries out supervision of the use of equipment which measures fuel consumption and the quantity of gas used for flaring and cold venting. Collection of the CO_2 tax on the shelf is the responsibility of the Norwegian Petroleum Directorate, and the Directorate makes an annual evaluation of the companies in order to assess the impact of the tax on CO_2 emissions.

Preliminary figures show that CO_2 emissions from taxable activities on the shelf were 9.7 million tonnes in 2000. This constitutes about 88 per cent of the total emissions of CO_2 from the petroleum activities as shown in Figure 3.1.1. Figure 3.1.2 shows how the emissions are divided by source.

3.5 THE EXTERNAL ENVIRONMENT

When the Norwegian Petroleum Directorate evaluates regional impact analyses, plans for development and operation, applications for consent and applications for the award of production licenses, the environmental aspects are a natural and fully integrated part of the Directorate's evaluation. The Directorate shall be a driving force to get the industry to develop and put to use technology that reduces emissions to air and discharges to sea, and thus maximize the value creation from the activities in a life-cycle perspective.

In 2000, four new plans for development and operation were approved (Grane, Kvitebjørn, Ringhorne and Valhall water injection). The possibility of implementing various environmental measures was a central aspect of the Directorate's evaluation of these plans.

Capturing lessons learned is an important part of the Directorate's work on the external environment. I 2000, two one-day seminars were organized with topics related to measures to reduce NO_X and measures to reduce discharges to sea.

The Norwegian Petroleum Directorate prepares annual forecasts for emissions of CO_2, NO_x, volatile organic compounds (nmVOC and methane) and produced water. The forecasts are an important basis from which to evaluate policy instruments so that national and international commitments may be followed up in a cost-effective manner.

In cooperation with the industry and the Norwegian Pollution Control Authority, procedures and systems have been further developed in 2000 for annual reporting of historical emissions/discharges from the fields on the shelf

In 2000, the Directorate has participated in the authorities' formulation of emission permits in order to reduce the emissions of nmVOC from the storage and loading of oil on the shelf.

Together with the Ministry of Petroleum and Energy, the Norwegian Petroleum Directorate has again prepared a booklet which provides an overview of environmental aspects on the Norwegian shelf (www.oed.dep.no).

With the arena of international cooperation under the Oslo and Paris Convention (OSPAR), the participating countries seek, among other things, to arrive at common standards and goals for reducing discharges to sea. The Norwegian Petroleum Directorate has contributed in connection with the Norwegian authorities' participation in this work.

3.6 GREENING OF GOVERNMENT - GREENING OF NPD

The Norwegian Petroleum Directorate is one of ten governmental bodies which, over the course of three years, is testing measures and systems in order to make operations as environmentally friendly as possible. Emphasis is placed on implementing the project so that the work can subsequently be continued in all governmental operations. The Norwegian Pollution Control Authority is assigned the responsibility for leading the project, while the Ministry of the Environment and the Ministry of Labor and Government Administration together are responsible for the project, which started in September 1998.

The project has six commitment areas: energy consumption, purchasing, construction, transportation, waste management, use of information and communication technology (ICT).

In this project, the Norwegian Petroleum Directorate focuses on how we can reduce our own environmental burdens with the aid of ICT. The action plan and quarterly progress reports are available at www.npd.no.

4.1 COOPERATION WITH NORAD

In 2000, the Norwegian Petroleum Directorate's assistance work financed by NORAD amounted to approximately five man-years. The majority of the assistance has been directed towards the following cooperating countries: Angola, Namibia, South Africa, Mozambique, Bangladesh and Vietnam. The Norwegian Petroleum Directorate also had limited cooperation with the Coordinating Committee for Coastal and Offshore Geoscience Programmes in East and Southeast Asia (CCOP) and the Southern Africa Development Community (SADC).

The Norwegian Petroleum Directorate has come a long way towards meeting NORAD's objective of establishing long-term cooperation agreements with relevant institutions in the countries concerned. All main projects are governed by such agreements. During the year, a new cooperation agreement with Angola has been prepared. The form of institutional cooperation varies in the different countries. For some of the larger projects, attempts are made to contribute actively to the development of the cooperating institution by offering experience from the entire range of the Norwegian Petroleum Directorate's sphere of operations, both technical and administrative.

Nicaragua (Instituto Nicaraguence de Energia INE)
NORAD's main project with Nicaragua was concluded at the beginning of the year. The project is being continued at a low level and the assistance is directed towards promotion of blocks for the first announcement round. Based on a professional viewpoint, the Norwegian Petroleum Directorate is of the opinion that the need for assistance to INE is very important at this stage in order to announce and award blocks in an expedient manner for the country.

An assessment of continued assistance to Nicaragua will be based on an evaluation of the program that has been carried out.

Angola (Ministry of Petroleum MINPET)
The Norwegian Petroleum Directorate has been involved in NORAD's projects related to Angola for several years and several Angolans have received training in the Norwegian Petroleum Directorate. Angola has also received support in connection with its work on statutes and regulations. NORAD made a decision concerning more extensive institutional cooperation at the end of 1999. In this connection a plan was developed for a continued cooperation program over a period of three years. The program itself was started in the autumn of 2000. One advisor has been assigned to assist MINPET in their work and in the implementation of the program.

Namibia (Ministry of Mines and Energy – MME)
In previous years, the Norwegian Petroleum Directorate has assisted in the formulation of regulations and follow-up of drilling operations. Namibia has built up a small, but highly qualified petroleum management system; MME.

In order to follow up the cooperation agreement, the Norwegian Petroleum Directorate stationed an advisor in Windhoek at the end of 1999. A number of activities were carried out in 2000, including assistance in developing new gas legislation, further development of supervisory methods, planning for promotion of the Namibian shelf, follow-up of plans for gas development, etc.

South Africa (Department of Mineral Resources and Energy – DME)
Organization of upstream oil and gas activities, establishment of framework conditions for marketing of natural gas in South Africa, organization of sales of petroleum, organization of state ownership interests in the petroleum sector and training are important areas for Norwegian assistance to DME. The project was started in the spring of 1999 with EDRC at the University of Cape Town as the executing institution on behalf of DME. The Norwegian Petroleum Directorate assists EDRC in the work and it includes the use of Norwegian researchers and consultants. An evaluation of the project work was carried out in the spring of 2000. The planned new programme will include focus on regional issues. DME will, to a greater extent, assume direct responsibility for Phase II.

Mozambique (National Directorate for Coal and Hydrocarbons – NDCH)
The Parliament approved a new Petroleum Act in December 2000. The Act will be implemented during the spring of 2001. The Norwegian Petroleum Directorate has continued its support in the formulation of resource, pipeline and safety regulations and model contracts for the petroleum activities. The plan is to conclude this work within six months after the Act enters into force.

The Norwegian Petroleum Directorate has also assisted the NDCH with the follow-up of plans for development of the Pande and Temane gas fields, with associated pipeline to South Africa. If Sasol/ENH realizes the projects, they will be among the largest industrial projects in Africa. In addition, the development of a central data storage system for seismic data was completed. Training and general institutional support have also been important activities.

Recently, an evaluation of the project was carried out that will prove to be very useful in connection with a possible continuation of the programme. In the spring of 2000, a request was submitted for further support for a new three-year period.

NDCH as an organization has been considerably strengthened due to the fact that several of the new employees have undergone extensive training programmes.

Eritrea
The Norwegian Petroleum Directorate has provided assistance concerning establishment of framework conditions, resource planning, assessment of environmental impact, studies of future gas strategy, promotion of exploration areas, data storage and seismic surveying. The

Ministry of Energy and Mineral Resources is the main cooperation partner.

The project has largely been concluded. The Norwegian Petroleum Directorate has assisted the authorities on an ad hoc basis. The activities have been linked to reprocessing of some seismic data in order to improve the data packages that are used when marketing the exploration areas.

Bangladesh

The Norwegian Petroleum Directorate has cooperated with Bangladesh for several years. In recent years, the cooperation has been carried out through the Hydrocarbon Unit under the Ministry of Energy and Mineral Resources, which is the Norwegian Petroleum Directorate's cooperating organization. During the course of the year, there have been a number of visits by representatives of the authorities from Bangladesh. The main work in the current phase of the project is aimed at the development of expertise within resource mapping and evaluation.

India (Directorate General of Hydrocarbons – DGH)

The Norwegian Petroleum Directorate has assisted our cooperation partner, DGH, with transfer of experience concerning a large part of the Directorate's sphere of responsibility. Storage of large quantities of data, general data management, resource evaluation, development planning and implementation of safety audits are areas of focus for the assistance.

The project was concluded in 2000. It is unclear whether this type of institutional cooperation with India will be continued.

Vietnam

The Norwegian Petroleum Directorate has continued its assistance concerning development of safety regulations and training in the area of safety management. The main cooperation partner is Petrovietnam (state oil company). The Norwegian Pollution Control Authority cooperates with the Norwegian Petroleum Directorate and has a similar environmental project with Petrovietnam.

Our project has been concluded and a final report is available. A total of ten workshops, 17 courses, one regulation, three guidelines and two system audits are part of what has been produced under the project.

Petrovietnam has presented ideas for new projects as a continuation of the cooperation with the Norwegian Petroleum Directorate. Implementation of safety regulations in relation to two large industrial projects (a new refinery and facilities for production, transportation and use of natural gas) have been proposed as the main commitment area for a new project, as well as establishing a system for internal quality assurance/safety audits in Petrovietnam. A workshop to prepare a new cooperation project was carried out during January 2000.

A programme running over 3 – 5 years with an annual framework of NOK 3 million will have a considerable effect in relation to implementation of the new safety regulations. Representatives from the Norwegian Petroleum Directorate have assisted Petrovietnam in completing the project application.

CCOP

The Norwegian Petroleum Directorate has provided assistance to the cooperation organization CCOP in Eastern and Southeastern Asia, which works on the mapping of petroleum resources in the area and lays plans for exploitation of these resources. Over the years, a number of technical seminars have been organized for members of the organization, inter alia with the assistance of PETRAD. Assistance has also been provided in the form of software and training in the use of modern analysis methods.

NORAD is currently considering the plans for continuation of the Resource Evaluation and Planning Project (REP).

SADC

A limited work specification has been established for support to SADC from the Norwegian Petroleum Directorate in the process of transforming SADC TAU (Energy Sector: Technical and Administrative Unit, Luanda) into an energy commission. The commission will take up its work on 1 April 2001.

Work is also underway on plans for a regional IT project for geotechnical services under SADC. The plan calls for the project to be managed and operated by the Petroleum Agency of South Africa. Several countries have already indicated that they are interested in using these services – without the services being actively marketed. (Mozambique, Tanzania, the Seychelles, Namibia).

Examples of issues SADC TAU is working on include harmonization of regulations, mapping of basins that extend over borders, regional competency enhancement measures, etc.

The Philippines

As a NORAD assignment, the Norwegian Petroleum Directorate assisted the Philippine Department of Energy (DOE) in selecting consultants for the Philippine Petroleum Resource Assessment project. The project was implemented in early 2000.

Sao Tome

Through NORAD, Sao Tome has received assistance in connection with negotiations with Mobil concerning licenses on the Sao Tome shelf. The project has been concluded.

4.2 COOPERATION WITH PETRAD

As a result of a pilot project carried out by the Norwegian Petroleum Directorate for NORAD during the period 1989-1993, Petrad was established as an independent foundation by the Norwegian Petroleum Directorate and

NORAD on 1 January 1994.

The objective of the foundation is to place Norwegian expertise and competence in the fields of management and administration of petroleum resources at the disposal of managers from the authorities and national oil companies in Africa, Asia, Latin America, Oceania and the CIS (Commonwealth of Independent States). This is accomplished by adapting seminars according to the inquiries and needs of the authorities in the above-mentioned regions, in addition to the organizing of two eight-week courses each year, "Petroleum Policy and Management" and "Management of Petroleum Operations", in Stavanger. All Petrad activities are aimed at senior and middle management personnel.

The activities are conducted through Petrad, engaging people who have a high level of competence in the petroleum activities. Up to now, Petrad has made use of more than 300 experts from around fifty companies, institutions and authorities as lecturers and resource persons in its courses and seminars. The eight-week courses in Stavanger integrate overall Norwegian experience and expertise within petroleum administration and management. Petrad also provides its course participants with comprehensive insight into the Norwegian petroleum industry and Norwegian culture through excursions and social events.

With the Norwegian Petroleum Directorate and NORAD as founders, Petrad is viewed as a neutral representative and conveyer of knowledge from the Norwegian public authorities. The response shows that PETRAD has had a significant effect as a "door opener" and a creator of contacts in many countries.

The location of Petrad in the Norwegian Petroleum Directorate means that the Directorate has a close and profitable cooperation with the foundation. The Norwegian Petroleum Directorate participates with lecturers and resource personnel both at courses and seminars in Norway and abroad.

During 2000, the Norwegian Petroleum Directorate contributed to the implementation of Petrad's two annual eight-week courses, "Management of Petroleum Development and Operations" and "Petroleum Policy and Management", held in the Norwegian Petroleum Directorate's offices, this time with 45 participants from 34 nations.

The Norwegian Petroleum Directorate has also contributed to the implementation of the following seminars in 2000:

- "Workshop on fiscal terms", Entebbe, Uganda
- "Management and Operation of Gas Pipeline Systems", Jakarta, Indonesia
- "E&P Data Management", Genting Highlands, Malaysia
- "Reservoir Evaluation - IOR/EOR", Teheran, Iran
- "E&P Data Management ", Qingdao, China,
- "E&P Data Management ", Yogyakarta, Indonesia,

This activity contributes to professional exposure to and understanding of different cultures while, at the same time, it increases the total expertise for those employees of the Directorate who are involved.

The Norwegian Petroleum Directorate is also involved in cooperation with Russia. This commitment is mainly coordinated under the Norwegian-Russian Forum for Energy and Environment, which is led by the Ministry of Petroleum and Energy. During the course of 2000, several seminars relating to this cooperation have been carried out under the direction of the Russian Ministry of Energy.

4.3 COOPERATION WITHIN RESOURCE MANAGEMENT

Annual meetings with the authorities in the North Sea area

As an oil and gas province, the North Sea is basically divided between the UK, the Netherlands, Germany, Norway and Denmark. Even though the individual fields are quite different, there are many similarities among the fields in the North Sea area. The petroleum resource management problems encountered by government agencies in these countries are therefore similar in many ways.

Consequently, for many years the Norwegian Petroleum Directorate has carried out regular meetings with British and Danish resource management authorities who share basically the same responsibilities for their sectors as the Norwegian Petroleum Directorate has for the Norwegian shelf. For the British shelf, it is the technical section of the Oil and Gas Division in DTI (Department of Trade and Industry) that is responsible for the resource aspect of exploration, development and operation activities. For the Danish shelf, the Danish Energy Agency (Energistyrelsen) has a similar responsibility.

The objective of the meetings is primarily to exchange opinions and experience from the respective activities. The UK activities are a few years more mature compared with our activities. It has therefore been very useful to draw on their experience with regard to improved oil recovery, development of small fields and unitization. The Danes have unique problems related to chalk fields, therefore, it has been valuable to acquire first-hand information on their experiences. Data management and the environment are other areas where it has been very useful to exchange experience. Close cooperation is envisaged also in these areas.

During the course of 2000, meetings were held with the Danish, British and Dutch authorities.

Annual meetings with other countries' authorities - exploration phase

Since 1983, annual meetings on technical issues have taken place between the Norwegian Petroleum Directorate and state administration units in other Northern and Western European countries with responsibility for exploration for oil and gas; England, Ireland, Denmark, Germany, the Netherlands, France, the Faeroe Islands and Norway take part in these meetings.

The responsibility for hosting the meetings is on a rotation basis among the various countries. Norway has hosted these meetings twice previously.

The main issues of discussion at the meetings are geotechnical, exploration technology and data management issues, as well as challenges faced by the various countries in their efforts towards efficient discovery of new oil and gas resources.

The combined expertise and experience at these meetings is substantial, and the access to information is important for each individual participating country with a view towards developing optimal exploration strategies.

Annual meetings with other countries' authorities - fiscal metering

In those countries where Norwegian petroleum is landed, the authorities' responsibility and roles are stipulated in treaties and cooperation agreements. There is extensive cooperation on the part of the authorities in order to safeguard the individual country's requirements for fiscal metering. An important forum in this cooperation is annual meetings in which status and future activities in the area of metering technology are reviewed. The Norwegian Petroleum Directorate has established cooperation agreements with German, Belgian, British and French authorities.

International research cooperation regarding improved oil recovery

Since 1979, Norway has participated in international research cooperation under the direction of the International Energy Agency (IEA) regarding improved oil recovery using advanced methods. Nine countries currently participate, and the cooperation largely consists of a commitment for a certain scope of research in specific areas and the exchange of the results.

Since 1986, the Norwegian Petroleum Directorate has represented Norway in the international management committee for this IEA cooperation.

Lecture activities

Also in 2000, the Norwegian Petroleum Directorate's staff members have been involved as lecturers in a number of international conferences, workshops and the like, in issues relating to resources. These activities are in demand and they are regarded as being very important in order to contribute to a mutual exchange of information and experience. The Norwegian shelf receives international focus with regard to exploration efficiency, development concepts, resource exploitation and use of new technology. Openness regarding both the overall resource scenario and solutions chosen on specific fields has provided a basis for stimulation of technology and promising cooperative relations between participants on the shelf. There is still considerable interest on the part of other countries as regards gaining insight into Norwegian resource management and the authorities' active instigator role in this context.

4.4 COOPERATION WITHIN ADMINISTRATION OF SAFETY AND WORKING ENVIRONMENT

4.4.1 INTERNATIONAL COOPERATION AGENCIES

The Norwegian Petroleum Directorate cooperates extensively with international technical institutions and government agencies, either directly or indirectly through Norwegian government agencies. The purpose of this cooperation is to:

- contribute to ensuring that safety and the working environment in the petroleum activities at least meet accepted international standards,
- ensure access to relevant information for competence building and regulatory development,
- contribute insight and experience in an international context in order to promote positive development in safety and working environment.

In general, the cooperation has consisted of participation in international governmental cooperation in Europe and in agencies of the United Nations, but also more direct cooperation with the various types of international and regional professional institutions. The most important partners in 2000 have been:

- NSOAF - North Sea Offshore Authorities Forum,
- IRF - International Regulators Forum
- the EU Commission, in cooperation with the Ministry of Local Government and Regional Development, on safety and the working environment,
- the United Nations' organizations IMO and ILO regarding safety at sea and the working environment, respectively,
- the United Nations' organization UNEP IE regarding environmental measures in offshore petroleum activities,
- European Diving Technology Committee (EDTC) and the Association of Offshore Diving (AODC) regarding diving safety,
- American Petroleum Institute (API); participation in the annual conference on technical petroleum topics and standardization,
- National Association of Corrosion Engineers (NACE), USA; participation in the annual conference on corrosion and surface treatment,
- CENELEC; cooperation on electrical engineering standardization in Europe through the Norwegian Electrotechnical Committee (NEK).
- Bilateral cooperation between the Norwegian Petroleum Directorate and similar supervision authorities in Denmark, the Netherlands and the United Kingdom.

NSOAF - North Sea Offshore Authorities Forum

In the field of Health, Safety and Environment, the Norwegian Petroleum Directorate participates in the North Sea Offshore Authorities Forum (NSOAF), where representatives from all the North Sea countries'

governmental authorities in charge of supervision of offshore petroleum activities take part. The goal of the forum is to ensure continuous improvement in health, safety and the environment in the petroleum activities in the North Sea.

The members of NSOAF meet for an annual working meeting where the activities are summarized and new tasks are discussed and initiated. Two independent working groups have been appointed by the forum and the Norwegian Petroleum Directorate is represented in these.

One of the groups is working with the aim of mutual acceptance of methods for documenting compliance with national regulatory requirements, such as the "Safety Case", which is specific to the individual mobile installation. This group is chaired by a Norwegian.

Audit teams have been established under this working group made up of representatives from several of the member countries. In 1999, these teams conducted joint audits directed towards five mobile drilling installations on the respective shelves of the participating countries. The reports have been presented to the relevant shipping companies in 2000, and the forum has requested feedback on the reports. The experiences were assessed as being very positive, both as regards development of a common understanding of different regulatory and supervisory strategies and as regards the actual findings and observations. The experience from the international activities is an important contribution to further cooperation in an NSOAF context in order to unitize and harmonize important authority issues in the North Sea basin. Based on these experiences, a new international audit will be initiated in 2001.

The other group, which has a Danish chairman, will seek to harmonize the requirements for safety training in the various North Sea countries. So far, the member countries have agreed on which elements of the training programmes are mutually acceptable and in which areas there are different requirements. In the next phase of the work, the working group will explore the opportunities for mutual acceptance of different types of special training.

IRF - International Regulators Forum

The International Regulators Forum (IRF) was established in 1994 by a group of authorities that wanted to promote a common understanding of issues related to safety, health and the environment.

The forum provides for exchange of ideas and opinions regarding methods and principles applied to efficient exercise of the supervision of safety and working environment, and exchanges facts regarding the supervision activities and informs one another regarding topical technical issues, regulatory developments, etc.

Within the possibilities and limitations stipulated through national frameworks for the activities, this will contribute to promoting a common understanding among the members with regard to issues such as: the role of the supervision authorities, use of policy instruments in the supervision, supervision methods, competence development, the relationship between the authorities and industry, etc.

The following participate in the cooperation in addition to Norway: Australia, the Netherlands, Canada, the UK and the USA. An increase in the number of participating countries is being considered.

The EU Commission

Since 1982, Norway, represented by the Norwegian Petroleum Directorate, has held observer status in the EU proceedings on safety and the working environment in offshore petroleum activities.

This work comes under the EU's Safety and Health Commission for the Mining and Other Extractive Industries (SHCMOEI), and the work is carried out by a working group called the Committee on Borehole Operations.

The work of the Committee on Borehole Operations includes following up the work on harmonizing requirements relating to safety training in the North Sea countries.

The Committee also works on updating and follow-up of the personal injury statistics for the petroleum activities.

In this connection, the Committee has given particular attention in 2000 to lifting operations between vessels and permanent/mobile installations, and has submitted a report to SHCMOEI on this.

The report, "Safety of Loading and Backloading of Cargo by Crane between Offshore Installations and Vessels", refers inter alia to the Norwegian Oil Industry Association's/Norwegian Shipowners' Association's "Guidelines for safe operation of offshore service vessels" and the Norwegian Petroleum Directorate's report "Causal relations of incidents in connection with lifting operations".

The report basically concluded by recommending more information on available guidelines, reports, etc., as well as more efficient use and follow-up of control systems. It is proposed that a workshop be arranged also in 2002 with presentations of the measures that have already been implemented.

SHCMOEI has approved the report without comments. Possible future work has not been determined.

UNEP - United Nations Environment Programme

The Norwegian Petroleum Directorate is involved as a contributor in a forum for environmental issues in offshore petroleum activities under the direction of the United Nations' organization, UNEP. The forum is an interactive, Internet-based information system with free access. The system contains information regarding pollution sources, effects of pollution, as well as information regarding management, technology, legislation, training programmes, etc.

Other contributors include the Dutch authorities, the oil industry through the E&P Forum, the Brazilian oil company Petrobras, the World Wildlife Fund and UNCTAD. The forum's web address is: www.natural-resources.org/offshore.

4.4.2 COOPERATION WITH RUSSIAN SUPERVISORY BODY - "THE BORIS PROJECT"

The cooperation with the Russian supervisory body, Gosgortekhnadzor, continued in 2000 with focus on safety management and supervision methodology. In order to provide the Russian authorities with insight into the supervision methods used on the Norwegian shelf, a supervision activity was carried out on a Russian installation in the Caspian Sea, where representatives from the Norwegian Petroleum Directorate participated as advisors to the Russian authorities' representatives. Both the company involved and the authorities expressed positive anticipation in respect of such joint supervision activity. For the company in question, the utility value was in having its safety management system evaluated so that the company could receive an indication of what would have to be changed in order for the company to approach an international standard.

4.4.3 RUN ARC - COMPREHENSIVE SAFETY AND ENVIRONMENT REGIME FOR OIL AND GAS ACTIVITIES ON THE RUSSIAN CONTINENTAL SHELF

The Russian Ministry of Natural Resources leads this cooperative effort. In 2000, the Russian project participants prepared an overview of the prevailing acts and rules, a draft procedure for processing license applications and a draft standard environmental specification for oil and gas production. These documents are undergoing a consultation process with the authorities and within the industry. So far, central Russian authorities have not made a decision regarding future progress of the project.

5.1 ACTIVITY PLAN

The annual activity plan is based on guidelines and requirements for the activities of the Norwegian Petroleum Directorate as they are described in the letter of award. The plan consists of one governing objective, four main objectives and underlying result targets and activity plans. The governing objective:

The Norwegian Petroleum Directorate shall contribute to creating the highest possible values for society from oil and gas activities founded on a sound management of resources, safety and the environment.

In 2000, the main goals and result targets were:

Main goal 1

Further develop an appropriate framework

- Complete the work on new regulations for resource management, safety and working environment, external environment and health, and hygienic factors in cooperation with other relevant authorities.
- Follow up national and international framework efforts that are important for resource management, safety and the working environment, safeguard this in the Norwegian Petroleum Directorate's regulations, and contribute to making the industry develop in accordance with national and international requirements.

Main goal 2

Provide good technical advice

- Collect, develop, analyze and make available relevant information on the petroleum activities in an efficient manner.
- Exploit the Norwegian Petroleum Directorate's petroleum expertise to fulfil Norwegian aid policy.
- Stipulate the outer borders of the Norwegian shelf through efficient data collection and mapping.
- Maintain an overview of and assess petroleum activities and petroleum resources on the Norwegian continental shelf.
- Maintain an overview of and assess the safety level on the Norwegian continental shelf.

Main goal 3

Ensure that the activities are carried out safely and efficiently

- Contribute to and carry out supervision to ensure that exploration, development and cessation take place in a manner that allows efficient recovery of the resources.
- Ensure correct payment of taxes and fiscal metering of petroleum.
- Check that the participants ensure that mobile installations comply with current safety and working environment regulations, while simultaneously giving the participants the necessary degree of predictability in connection with the use of such installations.
- Follow up to ensure that decision, change and development processes in relation to inter alia merger, organization, technology and models/concepts for the activities are carried out in accordance with current requirements for safety and working environment.
- Ensure that the participants maintain the technical condition of facilities and equipment so that they comply with acts and regulations, and are in accordance with current standards.

Main goal 4

Further develop a professional organization

- Further develop the Norwegian Petroleum Directorate's overall expertise, as well as organizational and control systems.
- Evaluate the organization of work tasks and composition of personnel in the NPD in accordance with the development programme "NPD 2000 and beyond".

5.2 ORGANIZATIONAL CHANGES

The Directorate reorganized its activities during the course of 2000. The desire was to develop a Directorate that could meet the challenges in the petroleum activities in the future and contribute to creation of value in the Norwegian society. On the basis of the Directorate's own needs and the Government's program to renew, reorganize and streamline the administration, the hierarchical organization has been replaced by an organization that:

- is flat and based on flexible, inter-disciplinary and interactive teams organized around prioritized products
- has focus on the development of our employees' expertise
- lets the responsibility for products, quality and process lie with the teams
- systematically focuses on optimization and streamlining of processes
- has few managers, and these few concentrate mainly on comprehensive strategies, processes and planning
- is further developed with the goal that the organization and production of services are based on the users' needs
- allows the development of a common culture and values to be a central theme

The new organization was implemented as from the beginning of 2001, while a new management was appointed as early as the autumn of 2000.

The new organization is divided into three product areas. The work in these areas is organized in teams with responsibility for both long-term and time-limited tasks.

The product area **Framework and advice** shall develop and propose frameworks for the petroleum activities in cooperation with the authorities, the industry and the trade unions. The area shall also provide advice and a basis for decision-making to superior ministries.

The product area **Supervision of activities** shall ensure that the players comply with the framework stipulated for the petroleum activities.

The product area **Data, information and knowledge management** shall take national responsibility to ensure that data and information from the petroleum activities are accessible to our partners and the public in general. The area shall also develop and communicate comprehensive knowledge regarding the petroleum activities.

5.3 STAFF

At the end of 2000, the Norwegian Petroleum Directorate had 358 employees. An additional 21 employees were on leave. Fifty-nine per cent of the employees are men and 41 per cent are women.

Four employees were hired in permanent positions. Of these, two came from oil-related activities.

Nine employees have left their positions, two of these as retirees.

In 1997, it was decided that the share of female managers at the senior and middle management level should be increased to at least 30 per cent by the end of 2001. At the end of the year, 30 per cent of managers were female.

5.4 BUDGET AND ECONOMY

EXPENSES

A total of NOK 311.1 million was spent on the Norwegian Petroleum Directorate's operations in 2000. The amount was appropriated as follows:

Salaries/comp. incl. empl. contrib.	154 438 582	
Goods and services	77 232 438	
Total operat. expenses, Item 01		231 671 020
Salaries/comp. incl. empl. contrib.	5 925 154	
Supervision expenses	11 571 886	
Assignments and cooperation[1)]	27 010 294	
Investigations	30 378 023	
Total special operat. exp., Item 21		74 885 357
Major acquis. of equipm., Item 45		4 590 287
TOTAL, CHAP. 1810		311 146 664

1) Includes e.g. expenses for Norad, Boris, PetroData and Force

In connection with the reporting for the National Accounts 2000, the Norwegian Petroleum Directorate has applied for transfer of funds to 2001, cf. authorizations granted in the Award Letter for 2000, regarding the following items:

Chapter 1810, Item 01	NOK 2 950 000
Chapter 1810, Item 21	NOK 2 990 000
Chapter 1810, Item 45	NOK 414 000

REVENUES

In addition to paid production royalties, area fees and CO_2 taxes totaling NOK 6.63 billion, the Norwegian Petroleum Directorate received NOK 101.2 million in miscellaneous revenues under Chapter 4810:

Fee and tax income	2 546 903
Assignment and cooperation income	39 375 319
Reimbursement of supervision expenses	46 078 457
Sale of survey material	0
Sale of publications	1 411 904
Miscellaneous income	2 026 364
Income from kindergarten	3 222 819
Reimbursements	2 113 016
Reimbursed for job schemes	500 040
Maternity benefits	1 503 246
Employer's contribution	211 955
Reimbursed for apprentices	220 000
Reimbursement of sick pay	1 718 663
Reimbursement of sick pay, empl. contrib.	242 332
Total revenues, Chap. 4810	101 171 017

5.5 INFORMATION ACTIVITIES

The Norwegian Petroleum Directorate's web site on the Internet may be found at http://www.npd.no. It contains inter alia reports and information concerning the Directorate's sphere of responsibility. Press releases, references to new publications and factual information (production figures, wells, discoveries, fields) are entered continuously. The information is available in both Norwegian and English and is searchable. The public can subscribe to press releases. There were an average of 74,000 visits to the web site per month (a total of 890,000 inquiries), an increase of 55 per cent from 1999. The new fact pages account for a large part of this increase.

2000 was the third annual volume of "Sokkelspeilet", which is also published in English under the name Norwegian Petroleum Diary. Both English and Norwegian copies are available in both printed and electronic versions. The main objective of the magazine is to reflect the main features and illustrate the background, ripple effects and contexts for the activity on the Norwegian shelf. The Norwegian Petroleum Diary appears to have been very well received in the target groups, which include Norwegian and foreign authorities, oil companies, business and industry in general, politicians, educational institutions, trade unions, the press and society at large - both at home and abroad. Circulation continued to rise in 2000, and has now reached about 9,000 copies.

The annual report occupies a central position in the Directorate´s information activities. The same is true of the continental shelf map, which was published with updated production licenses as of June 2000.

At year-end, the Norwegian Petroleum Directorate's list of publications contained 169 different publications, of which 15 were new publications. Seventeen publications can be read in their entirety on the web site. There are also links to "Lovdata" for those Acts and Regulations that appear on the list of publications. An up-to-date list of publications can be found at www.npd.no under "Information services".

Use of the Nordic reference database OIL amounted to approximately 32,000 hits last year. There were about 3000 hits per month divided among 600-700 different institutions. The oil companies are still the largest users of OIL, but students at universities and colleges also use the database regularly. Links have been set up to the documents that are accessible in full text format on the Internet. The database is accessible from the Norwegian Petroleum Directorate's web site.

2000 applications for inspection of documents under the Freedom of Information Act were processed. This is an increase of 30 per cent compared with last year. The

Directorate's public mail lists are sent on a daily basis to a common public service mail journal database, to which selected members of the Norwegian press have access. The lists have also been accessible from our web site under "Information services".

The Norwegian Petroleum Directorate issued 36 press releases during 2000. Most of these dealt with completed exploration wells and monthly production figures for the shelf. Several press conferences and press events were also organized.

The Norwegian Petroleum Directorate participated in Offshore Northern Seas (ONS), together with the two superior ministries, the Ministry of Local Government and Regional Development and the Ministry of Petroleum and Energy. The exhibit was based on the vignette "You are what you know". Almost the entire stock of 10,000 shelf maps were snatched up. In addition, about 5,550 publications from the Norwegian Petroleum Directorate were handed out, mainly the Annual Report, the Norwegian Petroleum Diary and a special ONS edition of the magazine.

The internal, five-year project in electronic case processing (EISak), which was started in 1999, shall be an instrument to further develop the Norwegian Petroleum Directorate as a professional organization. The most important task in 2000 was to provide for electronic processing, both internally and between the Norwegian Petroleum Directorate and other enterprises. A new electronic filing system was acquired and adapted to the new organization structure implemented at the end of the year.