



The Norwegian Petroleum Directorate
Annual Report

Offshore Norway 2001

A NEW OIL NORWAY

The 2001 oil and gas year was marked by changes. New companies, new structures, new organizations, new regulations and a new Storting White Paper on health, safety and the environment (HSE) are a few of the year's most prominent features. The Norwegian Petroleum Directorate was a key contributor, driving force and player in all of these processes.

Norway - a guarantor

Statoil was partially privatized in 2001, and 15 per cent of the State's Direct Financial Interest (SDFI) was sold to Statoil prior to the privatization. An additional 6.5 per cent of SDFI was put up for sale to other oil companies. Petoro was established as the management company for SDFI and Gassco was established as a 100% State-owned operator for all gas transport from the Norwegian Shelf.

These changes are taking place in a time of relative upheaval on the shelf, but also in the context of a crossroads where the future prospects for Norwegian petroleum activities are both long and interesting. The Norwegian Petroleum Directorate's estimates show that Norway can produce oil for at least 50 more years, and gas for more than 100 years. Norway thus emerges as one of Europe's gas guarantors for the coming century. The forecasts indicate that our gas exports will double over the long term, from today's 53 billion Sm³ to 100 billion Sm³ or more. For the first time ever, Norway discovered less gas than we produced in the 2001 exploration year. The status for the exploration year as a whole was 12 discoveries. All of the discoveries are small, but several can be tied in to existing infrastructure and thus become profitable. The result is in line with the exploration strategy, which emphasizes securing time-critical resources near already developed areas. There will be a need to look at the supply of resources in the year to come, particularly as regards gas.

The activity level on the shelf is high, and investments in the petroleum sector in 2001 amounted to more than NOK 50 billion. The high activity level is expected to continue for the next two years with annual investments of NOK 50-60 billion.

Risk level

In today's situation, the Norwegian Petroleum Directorate's role within HSE is of fundamental - and growing - significance. Recent years have shown a negative development in the risk level on the shelf. The Norwegian Petroleum Directorate cannot allow such a trend to manifest itself. A key task is therefore to find countermeasures that provide the greatest possible effect in relation to the effort.

In order to make it possible to draw clear conclusions concerning the risk level, the Norwegian Petroleum Directorate has worked on a project for measuring risk since 2000. This was followed up in 2001 by mapping of the causes of personal injury, work-related illness and undesirable incidents in general, and by evaluating and implementing follow-up measures in relation to this.

Milestones

Functional, unified and thoroughly prepared regulations are an important tool in the Norwegian Petroleum Directorate's work. In 2001, the Norwegian Petroleum Directorate concluded the extensive work of revising the regulations within the HSE area, after a four-year effort. The work was done together with the Norwegian Pollution Control Authority and the Norwegian Board of Health, keeping a close dialogue with the industry and the trade unions. Similar cooperation characterized the preparation of new resource regulations and metering regulations, which the Norwegian Petroleum Directorate prepared in cooperation with the Norwegian Oil Industry Association (OLF). The resource regulations entered into force on 1 July 2001, while the other new regulations entered into force on 1 January 2002.

In December 2001, the Ministry of Labour and Government Administration presented Storting White Paper No. 7 on health, environment and safety in the petroleum activities. The Norwegian Petroleum Directorate has made a significant contribution in the preparation of the white paper and has placed great emphasis on involving employees, employers and external milieus in the process. The White Paper is action-oriented, and contains proposals for concrete activities within a number of areas.

A changing Norwegian Petroleum Directorate

The Norwegian Petroleum Directorate has also experienced a marked internal change in the past year. The reorganization has altered long-standing traditions and procedures. There is no doubt that the new organizational model has led to significant changes. Nevertheless, the experience from one year of operations in the new Norwegian Petroleum Directorate gives us grounds for optimism and faith that we will achieve the central goals we have set for ourselves.



Stavanger, 12 March 2002

Gunnar Berge
Gunnar Berge
Director General

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1. Resource Management

1.1 INTRODUCTION

Norway implemented significant changes in its oil and gas policy during the course of 2001. Statoil was converted into a public limited company after being allowed to purchase 15 per cent of the State's Direct Financial Interest (SDFI). About 18 per cent of the shares were then sold. A further sell-down of as much as 6.5 per cent of SDFI to other players was also resolved. The Norwegian Petroleum Directorate has assisted the Ministry and its advisors in these processes. The remainder of the SDFI sale will take place in 2002 if satisfactory prices are achieved for the shares.

The Norwegian Petroleum Directorate has also contributed in the process surrounding the establishment of Petoro, the management company for SDFI, and Gassco, the new operating company for all gas transportation from the Norwegian shelf.

These changes, and the adaptations to the gas market directive within the European Economic Union (EU), required a complete shift in policy as regards gas marketing, allocation and sale in 2001. The work has progressed throughout all of 2001, but was not completely finalized at year-end. The Norwegian Petroleum Directorate has played an active role in several areas. The new systems will entail changes in the follow-up of fields and planned developments.

The petroleum industry is still facing a global deficit of expertise and recruiting problems, and the Norwegian Petroleum Directorate participates in projects to attempt to improve recruiting to the industry.

The resource report, issued in June 2001, shows that Norway will produce oil for the next 50 years, and gas for more than 100 years, although with a lower oil level than today. Slightly less than one-fourth of the original recoverable resources in place on the Norwegian continental shelf have been produced. The report, and the Ministry of Petroleum and Energy's work on oil and gas in the 21st century (OG21), point out that Norway must increase its commitment to building up expertise, research and development within the petroleum sector if the more than 75 remaining per cent of the recoverable resources are to be converted into funds for the benefit of the nation.

It is assumed that investments in the petroleum sector will exceed NOK 50 billion also in 2002. Operating costs are expected to show a slight increase, to approximately NOK 32 billion. Investments are expected to increase somewhat in the years up to 2005, and the operating costs will probably rise. There is uncertainty again this year concerning how rapidly the gas deliveries can/shall be developed, with possible associated investments in new pipelines and terminals or expansions. The investment level for the next ten years will be strongly influenced by the development in gas deliveries.

Norway still produces more oil than it finds, but the 2001 exploration year was the first in which we discovered less gas than was produced. Twelve discoveries were made, all small but mostly close to existing infrastructure, making several of them profitable. The results from the Barents Sea were encouraging, and the area could prove to be a significant addition to the nation's commercial resources.

Several large and small developments were considered in 2001. It is gratifying to see so much activity on smaller discoveries that can be tied in to existing infrastructure and provide good profitability. The Kristin development, which was considered and approved in 2001, offers great technical challenges linked to deep water, high temperature and high pressure. Snøhvit was also processed in 2001, for consideration by the Storting in March 2002. In this project, the Norwegian Petroleum Directorate may encounter new challenges connected with coordination of the entire development, including the land facility on Melkøya. The Ministry of Labour and Government Administration has determined that the Norwegian Petroleum Directorate shall function as the coordinating department, since the developments on land and offshore are completely interwoven, without a platform offshore and with all power supply from the land facility. Several new development plans are also expected in 2002.

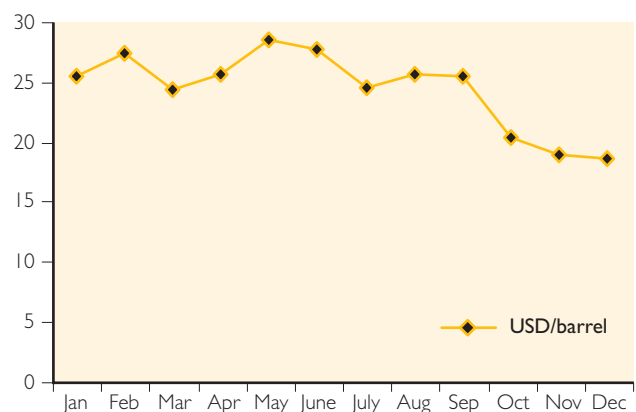
Data cooperation and standardization continue with a focus on bringing down costs and increasing the quality for all players. The new resource regulations, together with the new metering regulations, have been put in place during the course of 2001, thanks to a good effort and cooperation by all involved parties.

There is more focus on the environment than ever before. Cooperation with the Norwegian Pollution Control Authority (SFT) and the companies continues. The Norwegian Petroleum Directorate's quota trading proposal for NOx emissions has attracted considerable attention, and work will continue full force in 2002. The Ministry of Petroleum and Energy has commenced work on a new impact assessment of year-round activity in the Barents Sea and coastal areas. The Norwegian Petroleum Directorate will have broad-based participation in this effort in the year to come.

1.1.1 THE CRUDE OIL MARKET

Global oil production in 2001 (excluding NGL) is estimated to be about 66 million barrels per day (Source: Oil and Gas Journal (OGJ) 7 January 2002). This is equivalent to 3.8 billion Sm³ per year, and represents about the same volume as in 2000. Production from the OPEC countries declined by one per cent, from 27.9 million barrels per day in 2000 to 27.6 million barrels per day in 2001. Production outside of OPEC

Figure 1.1.1
Crude oil prices in 2001, Brent blend, USD/barrel, source IEA



increased by about one per cent, or approximately 0.5 million barrels per day.

Norway's oil production in 2001 averaged 3.1 million barrels per day. This is equivalent to 4.7 per cent of global production. OPEC's market share was approximately 42 per cent, the same as in 2000.

Figure 1.1.1 shows the development in crude oil prices in 2001, stated as the price of Brent Blend. Crude oil prices remained relatively high throughout the period, but showed a downward trend through the year.

1.1.2 THE NATURAL GAS MARKET

In 2001, Norway exported gas to the United Kingdom, Germany, the Netherlands, Belgium, France, Italy, Spain, Austria, the Czech Republic and Poland.

Exports from Norway amounted to 50.5 billion Sm³. This is an increase of approx. 1.9 billion Sm³ gas (3.9 per cent) from the previous year. The average energy content of the exported gas was 40.2 megajoules per cubic meter.

Organization of Norwegian gas sales

The first gas sales from the Norwegian shelf 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.

Since 1986, the sale of Norwegian gas has been coordinated by the government-appointed Gas Negotiation Committee (GFU) under the direction of Statoil and with participation by Norsk Hydro and Saga. Other companies were also involved in the negotiation of some gas sales contracts. In 1993, the authorities set up the Gas Supply Committee (FU). This committee, which consisted of the largest gas owners on the Norwegian shelf, was to have 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.

The compulsory Norwegian gas sales organization with GFU and FU ceased to exist on 31 December 2001. All binding gas sales contracts with customers on the Continent

that had not been allocated to fields at this date were allocated to the seller group that originally guaranteed the sales, and these groups shall be responsible for the contractual commitments. For the future, the disappearance of the GFU means that the individual licensees on the Norwegian shelf must now market and sell their own gas in the market.

Existing commitments

Field depletion contracts

The fields which delivered under field depletion contracts in 2001 were 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 the fields deliver to buyers on the Continent.

Supply contracts

The Troll gas sales agreements (TGSA) 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 supply contracts have also been signed.

New commitments

In 2001, the GFU entered into an agreement for sale of gas to Poland. This agreement concerns a gas sale totaling 73.5 billion Sm³, with start-up of deliveries in 2008. The contract has a duration of 15 years. Statoil and Petoro have signed an agreement for sale of gas to the United Kingdom totaling 24 billion Sm³ and deliveries commenced in 2001. The contract has a duration of 15 years. In addition, several agreements regarding short-term sales were signed with time frames ranging from one day to several months.

Contracts with buyers of Snøhvit LNG were also signed in 2001. The total scope of the contracts is 5.7 billion Sm³ LNG per year. According to the plan, deliveries will start in 2005 and last for 17-20 years. The East Coast of the USA will receive 2.4 billion Sm³/year, while the remaining volumes are linked to Spain and France.

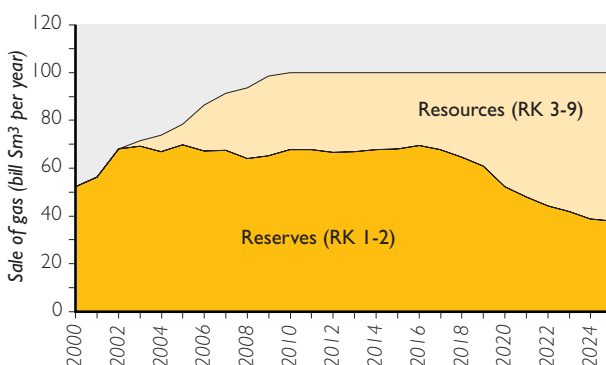
Potential new sales

Over time, it is expected that Norway's total gas sales may reach approx. 100 billion Sm³ or more per year over the next 10-20 years.

Current commitments will reach a level of about 82 billion Sm³ per year in 2008, and the increase in gas exports beyond this is expected to come from new sales.

Figure 1.1.2 shows anticipated future gas sales used as a basis for the 2002 national budget. The specific resource classes (RC) are described in detail in Chapter 1.3. In addition to sales from the Norwegian shelf come the gas volumes used for injection on the shelf, as well as production of power for operating field installations and transportation systems.

Figure 1.1.2
Anticipated sale of gas



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 increased 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, in the future, 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 2001, a total of 34.5 billion Sm³ gas was used for injection and 3.5 billion Sm³ gas was used for 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 at Tjeldbergodden in Møre og Romsdal.

In 1997, methanol production was started at Tjeldbergodden. Total gas consumption is 0.7 billion Sm³ 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.

In 1994, Statkraft, Statoil and Norsk Hydro set up a joint company, Naturkraft. Naturkraft plans to build gas power plants at Kårstø and Kollsnes. Total consumption of gas in the planned gas power plants will be 0.9 billion Sm³ gas per year.

In addition, plans were presented in 1999 for the construction of a power plant in Skogn in Nord-Trøndelag. Planned gas consumption is 1.1 billion Sm³ per year.

1.2 REGULATIONS

In the resource management area, the work on new regulations relating to resource management in the petroleum activities (the resource regulations) was completed when the regulations entered into force on 1 July 2001. New regulations relating to metering of petroleum for fiscal purposes and for calculating CO₂ tax were issued on 1 November 2001, with effect from 1 January 2002.

A number of topical guidelines have been prepared and tailored to provide detailed guidelines within specific areas under the resource regulations. We can mention in particular that the topical guidelines on resource classification were completed with a new resource classification system.

An overall presentation of the regulations for the petroleum activities with associated information has been provided on the Norwegian Petroleum Directorate's web pages at www.npd.no.

1.2.1 DELEGATIONS OF RESPONSIBILITY 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. Delegation applies to:

- 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 CO₂ Tax 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 recoverable 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. Nor can one directly compare this year's resource accounting with the previous year's as a consequence of the fact that the resource classification system was revised in 2001.

1.3.1 RESOURCE CLASSIFICATION SYSTEM

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 production of the resources

Table 1.3.1. The resource classification system

Resource Class	Resource Category	Project Status
Historical production	0	Sold and delivered petroleum
	1	Remaining reserves in production
Reserves	2	Reserves with approved plan for development and operation
	3	Reserves that the licensees have decided to develop
	4	Resources in the planning phase (approved development plan within four years)
Contingent	5	Resources where development is likely but unresolved
Resources	6	Resources where development is not very likely
	7	Resources where evaluation is not complete, new discoveries or resources from possible future measures for improved recovery
Undiscovered resources	8	Resources in mapped prospects
	9	Resources in leads and unmapped resources

is completed. 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.

The Norwegian Petroleum Directorate has revised the classification system for petroleum resources with effect from 1 July 2001, see Table 1.3.1. The purpose of the change has been to harmonize the classification with recently introduced and recognized international systems, and with the oil companies' systems. Reporting and communication of data between the companies and the authorities, and between authorities in other countries, will therefore be easier.

The most important changes are:

- Reserves are now defined as a separate class encompassing remaining reserves. This includes the categories "Fields in production", "Fields approved for development" and "Discoveries that the licensees have decided to develop".
- Produced volumes, which previously were a part of the reserves, are now excluded and form a separate class, Historical production.
- Petroleum volumes in producing fields that have been held back (primarily gas) and that can be produced without significant investments, may be reported as reserves. This includes inter alia significant gas volumes in Troll and Oseberg that were previously classified as resources in higher resource classes.
- Resources in the planning phase now have a time horizon of about four years until an anticipated PDO (Plan for Development and Operation) is submitted. Previously, there was one class for projects with a two-year planning horizon until PDO and another class for projects with a time horizon from two to ten years.
- In order to identify projects for improved recovery, the attributes F (First) and A (Additional) have been introduced for the resource categories. F shows new discoveries (and additional resources for existing discoveries and fields). A shows resources from projects for improved recovery. Resources from "Possible future measures for improved recovery" are now in Category 7A as compared with Class 8 in the old system.

Discovered resources that are not yet put into production are labeled "Contingent resources".

Terms

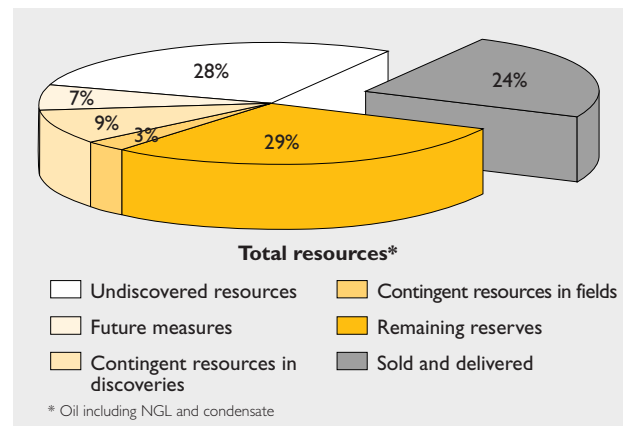
Resources is a generic term used for all estimated petroleum volumes.

Discovered resources comprise Resource Categories 0 - 7 and is used for petroleum volumes proven through drilling.

Contingent resources refers to discovered resources that have not yet been approved for development.

Undiscovered resources are petroleum resources that are presumed to be in place in defined play models, confirmed or unconfirmed, but that have not yet been proven through drilling (Resource Categories 8 and 9). There is

Figure 1.3.1
Distribution of the petroleum resources



always great uncertainty associated with analyses of undiscovered resources. The resource estimate stated for undiscovered resources is the statistical expected value.

Reserves comprise remaining recoverable, marketable petroleum resources that the licensees have decided to develop, and for which the authorities have approved a PDO or granted a PDO exemption. Reserves also include petroleum resources in deposits which the licensees have decided to develop, but which have not yet been considered by the authorities in the form of a PDO or PDO exemption. Reserves are distributed among Resource Categories 1 - 3.

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 included overall is in pressure communication through liquid 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.

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.

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.

1.3.2 RESOURCE ACCOUNTING FOR 2001

The estimated total for original recoverable resources on the Norwegian shelf is 13 832 million Sm³ oil equivalents (o.e.), see Table 1.3.2 and Figure 1.3.1. 7 291 million Sm³ oil equivalents (53 per cent) have already been developed or are approved for development. A total of 3 258 million Sm³

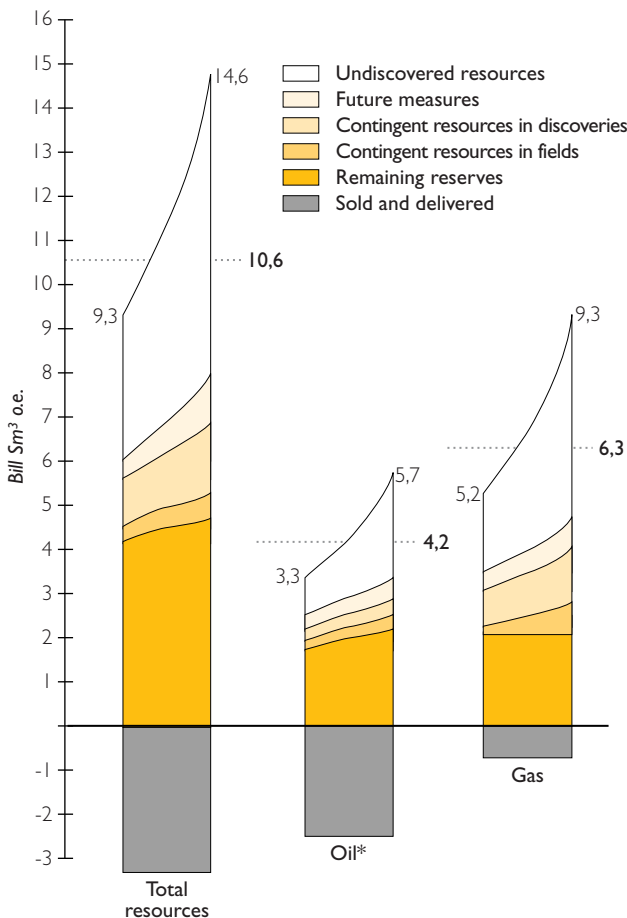
oil equivalents (24 per cent) have been sold, divided between 2 368 million Sm³ oil, 730 million Sm³ gas, 57 million tonnes NGL and 50 million Sm³ condensate.

Total remaining recoverable resources are 10 574 million Sm³ oil equivalents with a range of uncertainty from 9 300 to 14 600 million Sm³ oil equivalents, see Figure 1.3.2.

Remaining reserves in fields amount to 4 033 million Sm³ oil equivalents, divided among 1 501 million Sm³ oil, 2 189 billion Sm³ gas, 131 million Sm³ condensate and 111 million tonnes NGL. This also includes resources in 7121/4-1 Snøhvit, which the licensees have decided to develop, but where the PDO had not yet been approved by the authorities at year-end. This is an increase of 116 million Sm³ oil equivalents compared with last year. The comparison with last year's accounting is based on a data set that has been reclassified in accordance with the current classification system.

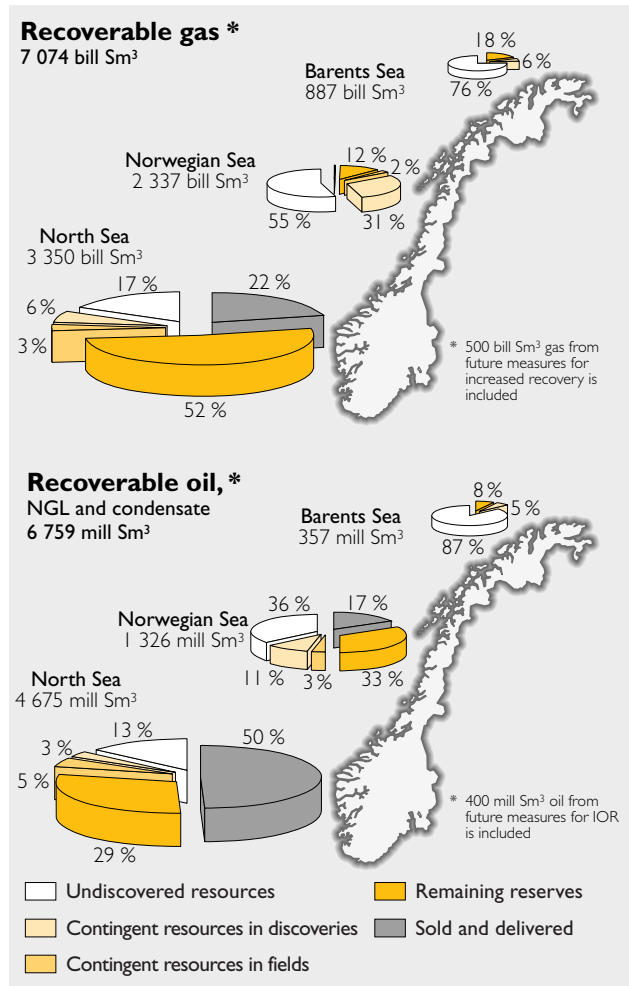
Contingent resources (additional resources) have been recorded in fields in the amount of 447 million Sm³ oil equivalents (three per cent). These are divided among 221 million Sm³ oil, 173 billion Sm³ gas, 16 million Sm³ condensate and 20 million tonnes of NGL. This is a reduction of 163 million Sm³ oil equivalents.

Figure 1.3.2
Uncertainty in estimates of petroleum resources



* Oil including NGL and condensate

Figure 1.3.3
Distribution of petroleum resources



In discoveries not yet approved for development, the total recoverable resources are 1 264 million Sm³ oil equivalents (nine per cent). This is a reduction of 198 million Sm³ oil equivalents. The estimate for undiscovered resources has increased by 180 million Sm³ oil equivalents, and is now estimated to be 3 930 million Sm³ oil equivalents (28 per cent). Resources from possible future measures for improved recovery are estimated at 900 million Sm³ oil equivalents (6.5 per cent).

The geographical distribution of the resources is shown in Figure 1.3.3.

1.3.3 RESOURCE STATUS

Historical production

Historical production describes the total volume of petroleum that has been sold and delivered. The produced volumes come from fields that are in production and from fields that have already been shut down.

Shutdown fields

The Frøy and Yme fields ceased production in 2001 after having produced for seven and six years respectively. There

Table 1.3.2 Total petroleum resources on the Norwegian continental shelf as of 31 December 2001

Change
2001-2000

Class	Category	Project Status	Oil	Gas	NGL	Conden- sate	Oil equi- valents ¹⁾	Oil equi- valents ¹⁾
			million Sm ³	billion Sm ³	million tonne	million Sm ³	million Sm ³	million Sm ³
Historical production	0	Sold and delivered as of 31 December 2001	2368	730	57	50	3258	251
Reserves		Fields and discoveries						
	1,00	Remaining reserves in production	1256	1439	78	49	2892	338
	37290,00	Reserves with approved/submitted PDO	245	750	34	82	1141	-222
		Total reserves	1501	2189	111	131	4033	116
Contingent Resources		Fields						
	4	In the planning phase	160	115	18	10	319	-129
	5	May be developed long-term	57	59	2	6	125	-36
	7F	New discoveries being evaluated	3	0	0	0	3	3
		Total contingent resources in fields	221	173	20	16	447	-163
		Total resources in fields and reserves	1722	2362	131	147	4480	-47
		Discoveries						
	4	In the planning phase	83	546	13	36	690	-249
	5	May be developed long-term	91	397	3	36	530	118
	7F	New discoveries being evaluated	16	28	0	1	45	-68
		Total contingent resources in discoveries	189	972	16	73	1264	-198
	7A	Possible future measures for improved recovery	400	500			900	-25
	Undis- covered Resources	8, 9	Undiscovered resources	1420	2510			3930
		Total	6100	7074	205	270	13832	161
		Remaining resources	3731	6343	147	219	10574	-90

1) 1.9 is the conversion factor for NGL in tonnes to Sm³.

are now a total of 12 fields on the Norwegian continental shelf where production has ceased. Production from these fields is shown in Table 1.3.3.

Producing fields

In 2001, there were 42 fields in production on the Norwegian Shelf, of which 37 fields in the North Sea and five fields in the Norwegian Sea. During the course of 2001, the Tambar, Huldra, Glitne and parts of Ringhorne fields were put into production, all of them in the North Sea. Ringhorne is included as part of the Balder field, and the production is reported under Balder.

Reserves

Remaining reserves in fields which are in production

As of 31 December 2001, there were 61 fields on the Norwegian continental shelf with approved plans for development and operation (PDOs), including the twelve 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. Table 1.3.4 provides information on fields in production or with approved PDOs.

The ratios between original recoverable volumes and remaining reserves in fields in production are shown in Table 1.3.5.

For some fields there have been significant changes in

the estimates of original recoverable reserves since last year's report. This is due, among other things, to the fact that data from some fields that was previously reported separately has been included with other fields in 2001, and is thus reported jointly. This applies to:

- Balder, which now includes Balder and Ringhorne,
- Gyda, which now includes Gyda and Gyda Sør,
- Sleipner Øst, which now includes Loke and Sleipner Øst, and
- Tordis, which now includes Tordis, Tordis Øst and Borg.

The new resource classification system has resulted in an increase in the gas reserves on Oseberg and Troll in that petroleum volumes that were previously classified as resources can now be classified as reserves. The oil and gas reserves on Draugen have increased by 29 million Sm³ oil equivalents after an upward adjustment of the in-place and recoverable resources. On Ekofisk, the oil reserves have been adjusted upward by 22 million Sm³. This is mainly due to an increase in the in-place and recoverable volumes, as well as improved recovery due to the drilling of additional wells. Gullfaks has reported an increase of ten million Sm³ oil, which is due to projects for improved oil recovery with approved PDOs. On Gungne, new mapping has led to an increased estimate of in-place and recoverable resources. The plan for development and operation of the Northern

Table I.3.3. Historical production from fields where production has ceased and from fields which are in production (Resource Category 0)

Field	Oil	Gas	NGL	Condensate	Oil equivalents ¹⁾	Discovery year ²⁾
	million Sm ³	Billion Sm ³	mill. tonnes	million Sm ³	million Sm ³	
Albuskjell	7,4	15,5	1,0		24,8	1972
Cod	2,9	7,3	0,5		11,2	1968
Edda	4,8	2,0	0,2		7,2	1972
Frøy	5,6	1,6		0,1	7,3	1987
Lille-Frigg	1,3	2,2		0,0	3,5	1975
Mime	0,4	0,1	0,0		0,5	1982
Nordøst Frigg		11,6		0,1	11,7	1974
Odin		27,3		0,2	27,5	1974
Tommeliten Gamma	3,9	9,7	0,6		14,6	1978
Vest Ekofisk	12,2	26,0	1,4		40,8	1970
Yme	7,9				7,9	1987
Øst Frigg		9,2		0,1	9,3	1973
Total shutdown fields	46,2	112,4	3,7	0,5	166,2	
Balder	8,9				8,9	1967
Brage	39,1	1,8	0,6	0,1	42,2	1980
Draugen	76,8	0,3	0,4	0,1	77,9	1984
Ekofisk	294,9	118,2	10,3		432,6	1969
Eldfisk	69,1	32,5	3,2		107,6	1970
Embla	7,4	2,4	0,3		10,4	1988
Frigg		113,9		0,5	114,3	1971
Glitne	0,7				0,7	1995
Gullfaks	286,0	19,5	1,5	0,7	308,9	1978
Gullfaks Sør	9,1	0,5	0,0	0,0	9,7	1978
Gungne			0,5	1,6	2,5	1982
Gyda	30,3	5,2	1,7		38,6	1980
Heidrun	71,6	3,5	0,1	0,0	75,3	1985
Heimdal	6,1	42,7			48,8	1972
Hod	6,9	1,3	0,2		8,6	1974
Huldra	0,0	0,1	0,0	0,0	0,1	1982
Jotun	13,5	0,5			14,0	1994
Murchison	13,0	0,3	0,3	0,0	14,0	1975
Njord	12,4				12,4	1986
Norne	36,8	1,1	0,1	0,0	38,1	1992
Oseberg	291,9	4,9	0,5	0,6	298,5	1979
Oseberg Sør	5,9				5,9	1984
Oseberg Vest	1,1				1,1	1984
Oseberg Øst	7,3				7,3	1981
Sleipner Vest		5,0	2,8	14,1	24,4	1974
Sleipner Øst		63,8	9,2	25,0	106,2	1981
Snorre	91,6	4,1	2,7	0,6	101,4	1979
Statfjord	518,0	44,9	10,2	3,2	585,6	1974
Statfjord Nord	23,1	1,2	0,3	0,1	24,9	1977
Statfjord Øst	24,4	1,8	0,5	0,1	27,3	1976
Sygna	3,2				3,2	1996
Tambar	0,5		0,0		0,6	1983
Tor	21,4	10,6	1,1		34,1	1970
Tordis	31,5	2,4	0,7	0,2	35,4	1987

Troll	96,4	111,3		1,6	209,3	1979
Ula	62,3	3,7	2,4		70,5	1976
Valhall	70,7	14,2	2,4		89,5	1975
Varg	4,7				4,7	1984
Veslefrikk	40,2	2,0	1,1	0,2	44,4	1981
Vigdis	19,3				19,3	1986
Visund	5,4				5,4	1986
Åsgard	20,1	4,3	0,6	0,9	26,5	1981
Total production	2321,9	617,9	53,6	49,6	3091,3	
Total sold and delivered	2368,1	730,4	57,3	50,1	3257,6	

1) 1.9 is the conversion factor for NGL in tonnes to Sm³.

2) Discovery year is discovery year for the oldest discovery well in the field.

and Southern flanks of the Valhall field has been approved, resulting in an increase of reserves amounting to 18 million Sm³ oil equivalents. The Visund licensees have resolved to submit a PDO for the gas reserves on the field.

Reserves in fields with an approved plan for development and operations.

There are eight fields that have approved plans for development and operations (PDOs), but which have not yet started producing. In 2001, the authorities approved PDOs for the Fram, Kristin, Mikkel, Sigyn and Vale fields. In addition come the Grane and Kvitebjørn fields approved in 2000, and Tune, approved in 1999.

Reserves in discoveries that the licensees have decided to develop

The licensees on 7121/4-1 Snøhvit decided to submit a PDO in September 2001.

Contingent resources

Resources in discoveries in the planning stage (Resource Category 4F)

At the turn of the year 2001/2002, 21 discoveries were undergoing planning for development, see Table 1.3.6. These are 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 five years. The petroleum resources in these discoveries constitute a total of 689 million Sm³ oil equivalents.

Compared with last year, the resources have been reduced by about 250 million Sm³ oil equivalents. The most important cause is that 7121/4-1 Snøhvit was moved to Category 3 after the PDO was submitted. In addition, the 2/4-17 Tjalve and 35/8-1 discoveries have been moved to Category 5. Additions to Resource Category 4 include the new 15/12-12 discovery and 25/4-3 Gekko, which is an old discovery that has undergone new interpretation. From Resource Category 5 come the 15/5-2 discovery and the 24/6-2 discovery.

Resources in discoveries where development is likely, but unresolved (Resource Category 5F)

At year-end there were a total of 50 discoveries where development is likely, but unresolved (Table 1.3.7). This includes discoveries where there are no concrete plans for development, and where it is assumed that a plan for development and operation will be approved in five years, at the earliest. The resource volume amounts to 530 million Sm³ oil equivalents. This is an increase of about 140 million Sm³ oil equivalents from last year, and is largely due to the fact that the 6505/6-1 discovery (Viktoria) with 118 billion Sm³ gas and 7122/7-1 Goliat with 11 million Sm³ oil, discovered in 2000, have been moved from Category 7F to 5F. The 35/3-2 Agat discovery has been located for several years in a relinquished area, which has now been re-awarded. The resource estimate for 35/3-2 Agat has been reduced by 23 billion Sm³ gas, but the discovery is undergoing further exploration. In the 15/3-1 Gudrun discovery, the resources have been adjusted upward by 10 million Sm³ oil equivalents.

This resource category also includes discoveries located in relinquished areas. The Norwegian Petroleum Directorate assumes that some of these areas could be re-awarded and that the discoveries could be developed over the long term.

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

A number of technical discoveries have been made over the years where the petroleum volume is either so small or so difficult to produce that, even over the long term, it seems unlikely that development will take place. Since the Norwegian Petroleum Directorate has a low expectation of these discoveries being developed, they are not included in the year's accounting. However, during the course of 2002, the Norwegian Petroleum Directorate will implement a more detailed assessment of the discoveries to determine whether any of them have a long-term possibility of being produced.

Resources in discoveries where evaluation is not complete (Resource Category 7F)

As of the end of the year, seven discoveries have been registered in this resource category. The preliminary esti-

Table 1.3.4 Fields in production and fields with approved plans for development and operation

Field	Reserves	Discovery	Operator	Production licence
	million Sm ³ o.e.	year ⁴⁾		Agreement-based area
Balder (incl. Ringhorne)	75,3	1967	Esso Exploration and Production Norway A/S	001
Brage	48,9	1980	Norsk Hydro Produksjon AS	Brage
Draugen	148,2	1984	A/S Norske Shell	093
Ekofisk	679,0	1969	Phillips Petroleum Company Norway	018
Eldfisk	161,5	1970	Phillips Petroleum Company Norway	018
Embla	21,4	1988	Phillips Petroleum Company Norway	018
Fram ¹⁾	19,8	1987	Norsk Hydro Produksjon AS	090
Frigg	122,1	1971	TotalFinaElf Exploration Norge AS	Frigg
Glitne	3,6	1995	Statoil ASA	048 B
Grane ¹⁾	120,0	1991	Norsk Hydro Produksjon AS	Grane
Gullfaks	361,1	1978	Statoil ASA	050
Gullfaks Sør	98,7	1978	Statoil ASA	050
Gungne	15,7	1982	Statoil ASA	046
Gyda	43,3	1980	BP Amoco Norge AS	019 B
Heidrun	208,4	1985	Statoil ASA	Heidrun
Heimdal	48,7	1972	Norsk Hydro Produksjon AS	Heimdal
Hod	9,8	1974	BP Amoco Norge AS	033
Huldra	18,1	1982	Statoil ASA	Huldra
Jotun	31,9	1994	Esso Exploration and Production Norway A/S	Jotun
Kristin ¹⁾	85,7	1997	Statoil ASA	Haltenbanken Vest
Kvitebjørn ¹⁾	75,6	1994	Statoil ASA	193
Mikkil ¹⁾	33,3	1987	Statoil ASA	Mikkil
Murchison	14,7	1975	Kerr McGee North Sea (UK) Ltd	Murchison
Njord	23,7	1986	Norsk Hydro Produksjon AS	Njord
Norne	100,8	1992	Statoil ASA	Norne
Oseberg	435,0	1979	Norsk Hydro Produksjon AS	Oseberg
Oseberg Sør	61,0	1984	Norsk Hydro Produksjon AS	Oseberg Sør
Oseberg Vest	8,0	1984	Norsk Hydro Produksjon AS	Oseberg
Oseberg Øst	25,3	1981	Norsk Hydro Produksjon AS	053
Sigyn ¹⁾	11,1	1982	Esso Exploration and Production Norway A/S	072
Sleipner Vest	144,1	1974	Statoil ASA	Sleipner Vest
Sleipner Øst	101,7	1981	Statoil ASA	Sleipner Øst
Snorre	253,3	1979	Norsk Hydro Produksjon AS	Snorre
Statfjord	647,1	1974	Statoil ASA	Statfjord
Statfjord Nord	44,4	1977	Statoil ASA	037
Statfjord Øst	43,6	1976	Statoil ASA	Statfjord Øst
Sygna	13,4	1996	Statoil ASA	Sygna
Tambar	10,1	1983	BP Amoco Norge AS	065
Tor	39,5	1970	Phillips Petroleum Company Norway	Tor
Tordis	59,3	1987	Norsk Hydro Produksjon AS	089
Troll ²⁾	1586,2	1979	Norsk Hydro Produksjon AS	Troll
Troll ³⁾		1983	Statoil ASA	Troll
Tune ¹⁾	29,1	1996	Norsk Hydro Produksjon AS	190
Ula	86,6	1976	BP Amoco Norge AS	019
Vale ¹⁾	5,3	1991	Norsk Hydro Produksjon AS	036
Valhall	200,1	1975	BP Amoco Norge AS	Valhall
Varg	5,2	1984	Norsk Hydro Produksjon AS	038
Veslefrikk	59,8	1981	Statoil ASA	052
Vigdis	31,9	1986	Norsk Hydro Produksjon AS	089
Visund	103,1	1986	Norsk Hydro Produksjon AS	Visund
Åsgard	356,5	1981	Statoil ASA	Åsgard

1) Fields with approved development plans where production was not underway as of 31 December 2001

2) The resources comprise the total resources on Troll, also the part operated by Statoil ASA.

3) The resources are included in the above row.

4) Discovery year is discovery year for the oldest discovery well in the field.

Table I.3.5 Original saleable volume and remaining reserves in fields in production, in fields with approved plan for development and operation and for discoveries that the licensees have decided to develop.

	Original saleable ¹⁾					Remaining reserves ⁵⁾					
	Oil		Gas	NGL	Condensate	Oil-		Gas	NGL	Condensate	Oil-
	mill. Sm ³	bill. Sm ³	mill. tonnes	mill. Sm ³	mill. Sm ³	mill. Sm ³	bill. Sm ³	mill. tonnes	mill. Sm ³	mill. Sm ³	
Balder ^{a)}	72,4	2,9	0,0	0,0	75,3	63,5	2,9	0,0	0,0	66,3	
Brage	44,9	2,6	0,7	0,0	48,9	5,8	0,8	0,1	0,0	6,8	
Draugen	137,0	7,4	2,0	0,0	148,2	60,2	7,1	1,6	0,0	70,4	
Ekofisk	478,5	174,0	14,0	0,0	679,0	183,6	55,8	3,7	0,0	246,4	
Eldfisk	108,5	45,3	4,1	0,0	161,5	39,4	12,8	0,9	0,0	53,9	
Embla	13,6	6,6	0,7	0,0	21,4	6,1	4,2	0,4	0,0	11,1	
Fram ³⁾	16,1	3,6	0,1	0,0	19,8	16,1	3,6	0,1	0,0	19,8	
Frigg	0,0	121,6	0,0	0,5	122,1	0,0	7,7	0,0	0,0	7,7	
Glitne	3,6	0,0	0,0	0,0	3,6	2,8	0,0	0,0	0,0	2,8	
Grane ³⁾	120,0	0,0	0,0	0,0	120,0	120,0	0,0	0,0	0,0	120,0	
Gullfaks ^{b), 5)}	335,2	22,2	2,0	0,0	361,1	49,2	2,7	0,5	-0,7	52,2	
Gullfaks sør ^{c)}	40,2	47,4	5,8	0,0	98,7	31,1	46,9	5,8	0,0	89,0	
Gungne	0,0	10,1	1,3	3,1	15,7	0,0	10,1	0,8	1,5	13,1	
Gyda ^{d)}	34,1	5,8	1,8	0,0	43,3	3,8	0,6	0,1	0,0	4,7	
Heidrun	178,0	28,2	1,2	0,0	208,4	106,4	24,7	1,1	0,0	133,1	
Heimdal	6,9	41,8	0,0	0,0	48,7	0,8	0,3	0,0	0,0	1,0	
Hod	7,8	1,6	0,2	0,0	9,8	0,9	0,3	0,0	0,0	1,2	
Huldra	5,0	12,9	0,1	0,0	18,1	4,9	12,8	0,1	0,0	17,9	
Jotun	31,1	0,8	0,0	0,0	31,9	17,6	0,3	0,0	0,0	17,9	
Kristin ³⁾	0,0	34,9	8,5	34,6	85,7	0,0	34,9	8,5	34,6	85,7	
Kvitebjørn ³⁾	0,0	54,2	0,5	20,6	75,6	0,0	54,2	0,5	20,6	75,6	
Mikkell ³⁾	0,0	19,8	4,2	5,5	33,3	0,0	19,8	4,2	5,5	33,3	
Murchison	13,6	0,4	0,4	0,0	14,7	0,5	0,1	0,1	0,0	0,7	
Njord	23,7	0,0	0,0	0,0	23,7	11,3	0,0	0,0	0,0	11,3	
Norne	84,8	13,5	1,3	0,0	100,8	47,9	12,5	1,2	0,0	62,7	
Oseberg ⁵⁾	346,0	89,0	0,0	0,0	435,0	54,1	84,1	-0,5	-0,6	136,5	
Oseberg Sør	54,0	7,0	0,0	0,0	61,0	48,1	7,0	0,0	0,0	55,1	
Oseberg Vest	2,0	6,0	0,0	0,0	8,0	0,9	6,0	0,0	0,0	6,9	
Oseberg Øst	24,5	0,8	0,0	0,0	25,3	17,2	0,8	0,0	0,0	18,0	
Sigyn ³⁾	0,0	5,3	1,5	3,0	11,1	0,0	5,3	1,5	3,0	11,1	
Sleipner Vest	0,0	104,0	6,9	27,0	144,1						
Sleipner Øst ^{e)}	0,0	55,2	11,3	25,2	101,7						
Sleipner Vest og Øst ⁶⁾						0,0	90,3	6,2	13,1	115,2	
Snorre ⁵⁾	231,6	8,9	6,7	0,0	253,3	140,0	4,8	4,0	-0,6	151,9	
7121/4-1 Snøhvit ⁴⁾	0,0	163,5	5,1	18,1	191,3	0,0	163,5	5,1	18,1	191,3	
Statfjord ⁵⁾	561,4	58,4	14,4	0,0	647,1	43,4	13,5	4,2	-3,2	61,6	
Statfjord Nord	40,0	2,8	0,8	0,0	44,4	16,9	1,6	0,5	0,0	19,5	
Statfjord Øst	37,1	4,1	1,3	0,0	43,6	12,6	2,2	0,7	0,0	16,3	
Sygna	12,7	0,0	0,0	0,0	12,7	9,5	0,7	0,0	0,0	10,2	
Tambar	7,2	2,4	0,3	0,0	10,1	6,7	2,4	0,3	0,0	9,6	
Tor	25,8	11,4	1,2	0,0	39,5	4,4	0,8	0,1	0,0	5,4	
Tordis ⁵⁾	52,5	4,2	1,4	0,0	59,3	20,9	1,7	0,7	0,0	24,0	
Troll ^{g)}	215,9	1321,7	24,8	1,6	1586,2	119,5	1210,4	24,8	0,0	1376,9	
Tune ³⁾	6,1	22,9	0,1	0,0	29,1	6,1	22,9	0,1	0,0	29,1	
Ula	77,9	3,7	2,6	0,0	86,6	15,6	0,0	0,3	0,0	16,1	
Vale ³⁾	3,0	2,3	0,0	0,0	5,3	3,0	2,3	0,0	0,0	5,3	
Valhall	166,7	25,6	4,1	0,0	200,1	96,0	11,4	1,6	0,0	110,5	
Varg	5,2	0,0	0,0	0,0	5,2	0,5	0,0	0,0	0,0	0,5	
Veslefrikk	54,6	3,1	1,1	0,0	59,8	14,3	1,1	0,0	0,0	15,4	
Vigdis	29,8	2,1	0,0	0,0	31,9	10,5	2,1	0,0	0,0	12,6	
Visund	42,9	50,5	5,1	0,0	103,1	37,5	50,5	5,1	0,0	97,7	
Åsgard	71,4	190,7	27,6	42,0	356,5	51,3	186,4	27,0	41,1	330,0	
Total	3823,1	2803,0	164,9	181,2	7120,6	1500,8	2186,8	111,3	132,4	4031,3	

1) The table states expected values. All estimates are subject to uncertainty.

2) The conversion factor for NGL in tonnes to Sm³ is 1.9

3) Fields that are approved for development but have not yet started producing at year-end (Resource Category 2).

4) Discoveries that the licensees have decided to develop (Resource Category 3)

5) Negative figures for remaining reserves in some fields is due to the fact that the product is not reported under original recoverable volume. This applies to produced NGL and condensate.

6) The production from Sleipner Vest and Øst is measured together. As a result of this, the remaining reserves are also shown together.

a) Balder includes Ringhorne

b) Gullfaks includes Gullfaks Vest

c) Gullfaks Sør includes Rimfaks and Gullveig

d) Gyda includes Gyda Sør

e) Sleipner Øst includes Loke

f) Tordis includes Tordis Øst and Borg.

g) Troll includes TOGI

Table I.3.6. Resources in discoveries in the planning stage (Resource Category 4F)

Discovery	Oil	Gas	NGL	Condensate	Oil-equivalents ¹⁾	Discovery year ²⁾
Resource Category 4F	mill. Sm ³	bill. Sm ³	mill. tonnes	mill. Sm ³	mill. Sm ³	
15/12-12	6,6	2,7			9,3	2001
15/5-1 Dagny		3,6	0,5	1,0	5,5	1978
15/5-2		5,5	0,1	0,2	5,9	1978
15/9-19 S Volve	7,5	0,8	0,2		8,6	1993
2/12-1 Freja	2,4	0,4	0,1		3,0	1987
24/6-2	7,9	3,9			11,8	1998
25/11-16	3,6				3,6	1992
25/4-3 Gekko		7,6		1,3	8,9	1974
25/5-3 Skirne	0,9	4,3			5,2	1990
25/5-4 Byggve	0,7	2,4			3,0	1991
25/5-5	4,3				4,3	1995
3/7-4 Trym		3,3		0,8	4,1	1997
30/6-17	0,3	1,7			2,0	1986
30/6-18 Kappa	0,8	2,7		0,2	3,7	1986
30/9-19	1,6	4,9			6,5	1998
35/9-1 Gjøa	6,5	29,4	1,5		38,7	1989
6305/5-1 Ormen Lange		400,0		23,7	423,7	1993
6406/2-1 Lavrans		13,4	2,5	4,7	22,9	1995
6407/1-2 Tyrihans Sør	16,6	26,1	3,6		49,5	1983
6507/5-1 Skarv	16,5	33,8	4,3	4,1	62,4	1998
6608/10-6 Svale	7,0				7,0	2000
Total	83,0	546,3	12,8	36,1	689,7	

1) 1.9 is the conversion factor for NGL in tonnes to Sm³.

2) Discovery year is discovery year for the oldest discovery well in the discovery.

Table I.3.8. Resources in new discoveries where evaluation is not complete (Resource Category 7F)

Discovery	Oil	Gas	NGL	Condensate	Oil-equivalents ¹⁾	Discovery year ²⁾
Resource Category 7F	mill. Sm ³	bill. Sm ³	mill. tonnes	mill. Sm ³	mill. Sm ³	
30/6-27	1,4	1,1			2,5	2001
34/8-12	3				3	2001
6506/11-7	9,3	4,5			13,8	2001
6507/11-6		2,6		0,3	2,9	2001
6507/7-13	1,5				1,5	2001
7019/1-1		11,5			11,5	2001
7228/7-1	0,5	8,7		0,6	9,8	2001
Total	15,7	28,4	0	0,9	45	

1) 1.9 is the conversion factor for NGL in tonnes to Sm³.

2) Discovery year is discovery year for the oldest discovery well in the discovery.

Table I.3.7. Resources in discoveries where development is likely, but not yet resolved (Resource Category 5F)

Discovery	Oil	Gas	NGL	Condensate	Oil-equivalents ¹⁾	Discovery year ²⁾
Resource Category 5F	mill. Sm ³	bill. Sm ³	mill. tonnes	mill. Sm ³	mill. Sm ³	
1/2-1	2,1				2,1	1989
1/5-2 Flyndre	5,1	1,6			6,6	1974
15/3-1 S Gudrun		15,6		13,8	29,4	1975
15/3-4	7,5	3,8			11,3	1982
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
2/2-5	2,4				2,4	1992
2/4-10	2,4				2,4	1973
2/4-17 Tjalve	1,0	1,6	0,1		2,8	1992
2/5-3 Sørøst Tor	1,0				1,0	1972
2/6-5	0,9				0,9	1997
2/7-19	3,6	3,4			7,1	1990
2/7-22		0,6			0,6	1990
2/7-29	1,5	0,6			2,1	1994
24/6-1 Peik		5,3		1,2	6,5	1985
24/9-5	2,7				2,7	1994
25/8-4	1,0				1,0	1992
30/10-6		5,7			5,7	1992
30/6-26 Gamma Vest	2,9	1,5			4,4	2001
30/7-6 Hild	13,1	33,4			46,5	1978
31/4-11	0,4				0,4	2000
33/9-6 Delta	0,5				0,6	1976
34/10-23 Gamma		12,8		1,3	14,1	1985
34/7-18	1,7				1,7	1991
35/10-2		1,6			1,6	1996
35/3-2 Agat		20,0			20,0	1980
35/8-1		15,6		2,8	18,4	1981
35/9-3	0,3	0,4			0,7	1997
36/7-2	1,1				1,1	1997
6406/2-6 Ragnfrid		7,9		5,7	13,6	1998
6406/2-7 Erlend		2,9		3,2	6,1	1999
6406/3-2 Trestakk	5,3	1,8			7,0	1986
6407/9-9	0,3	0,3			0,6	1999
6506/11-2 Lange	3,5	1,8			5,3	1991
6506/12-3 Lysing	1,2	0,2			1,4	1985
6506/6-1		118,0			118,0	2000
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
6608/11-2 Falk	2,0	0,1			2,1	2000
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		0,2	6,6	1986
7122/6-1	2,6	5,4		0,6	8,6	1987
7122/7-1 Goliat	11,3				11,3	2000
7124/3-1		2,1			2,1	1987
Total	90,7	379,4	0,9	30,4	502,3	

 1) 1.9 is the conversion factor for NGL in tonnes to Sm³.

2) Discovery year is discovery year for the oldest discovery well in the discovery.

Table 1.3.9 Discoveries that in 2001 are reported as parts of other fields or discoveries.

Discovery	Reported in field	Discovery year
2/7-8	Eldfisk	1973
35/11-2	Fram	1987
35/11-7	Fram	1992
35/11-8 S	Fram	1996
34/10-34 Gullfaks Vest	Gullfaks	1991
34/10-17 Rinfaks	Gullfaks Sør	1983
34/10-21	Gullfaks Sør	1984
34/10-37 Gullveig	Gullfaks Sør	1995
34/10-43 S	Gullfaks Sør	2001
34/10-44 S Lunde	Gullfaks Sør	2001
15/9-20 S	Gungne	1994
2/1-9 Gyda Sør	Gyda	1991
6507/8-4 Heidrun Nord	Heidrun	1990
2/11-10 S	Hod	1994
25/7-3 Jotun	Jotun	1995
25/8-8 S Jotun	Jotun	1995
33/9-0 Murchison NØ Horst	Murchison	1989
6608/10-4	Norne	1994
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
30/6-19 Beta Sadel	Oseberg Øst	1986
25/8-1 Ringhorne	Balder	1970
25/8-10 S Ringhorne	Balder	1997
25/8-11 Ringhorne	Balder	1997
16/7-7 S	Sigyn	1997
15/9-17 Loke	Sleipner Øst	1983
34/7-25 S	Tordis	1996
15/12-10 S	Varg	1996
30/3-6 S	Veslefrikk	1994
30/3-7 A	Veslefrikk	1998
30/3-7 B	Veslefrikk	1998
30/3-7 S	Veslefrikk	1995
30/3-9	Veslefrikk	2000
34/7-16	Vigdis	1990
34/7-23 S	Vigdis	1994
34/7-29 S	Vigdis	1998
34/7-31	Vigdis	2001
34/8-4 S	Visund	1991
9/2-3	Yme	1990
9/2-6 S	Yme	1996
9/2-7 S	Yme	1997
9/2-9 S	Yme	1999
6506/12-1 Smørbukk	Åsgard	1985
6506/12-3 Smørbukk Sør	Åsgard	1985
Discovery	Reported in discovery	Disc. year
2/7-31	2/7-19	1999
24/9-6	24/9-5	1994
30/7-2	30/7-6 Hild	1975
35/8-2	35/8-1	1982
36/7-1	35/9-1 Gjøl	1996
6406/1-1	6406/2-7 Erland	2001

6407/1-3 Tyrhans Nord	6407/1-2 Tyrhans	1984
6507/5-3 Snadd	6507/5-1 Skarv	2000
7120/7-1 Askeladd Vest	7121/4-1 Snøhvit	1982
7120/7-2 Askeland Sentral	7121/4-1 Snøhvit	1983
7120/8-1 Askeladd	7121/4-1 Snøhvit	1981
7120/9-1 Albatross	7121/4-1 Snøhvit	1982
7121/7-1	7121/4-1 Snøhvit	1984
7121/7-2 Albatross Sør	7121/4-1 Snøhvit	1986

mates for discoveries in Resource Category 7F amount to about 45 million Sm³ oil equivalents (Table 1.3.8). The estimates are preliminary and associated with great uncertainty.

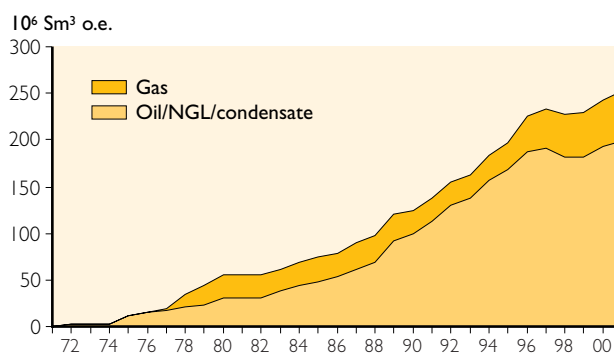
1.4 PRODUCTION OF OIL AND GAS

The production of oil and gas on the Norwegian shelf amounted to 251.4 million Sm³ oil equivalents in 2001. Production in 2000 amounted to 244.4 million Sm³ 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.

Figure 1.4.1.
Oil and gas production on the Norwegian continental shelf 1971-2001



1.5 PETROLEUM ECONOMY

1.5.1 SALE OF PETROLEUM FROM THE NORWEGIAN CONTINENTAL SHELF

In 2001, 155.7 million tonnes of crude oil were sold from the Norwegian continental shelf. This represents an increase of 1.8 per cent compared with 2000. The United Kingdom was the largest receiver, accounting for 22.7 per cent of the shipments. Norway received 15.4 per cent, the Netherlands 14.5 per cent, France 12.8 per cent and Sweden 5.5 per cent. In 2000, Norway received 15.7 per cent. Figure 1.5.1 shows crude oil sales distributed by country in the period 1992 - 2001.

Sale of NGL (including condensate) from the Norwegian continental shelf reached 9.7 million tonnes in 2001.

Norway exported 50.5 billion Sm³ gas in 2001. This is an increase of 3.9 per cent compared with 2000. Sales comprised 19.3 billion Sm³ to Germany, 2.2 billion Sm³ to the United Kingdom, 11.6 billion Sm³ to France, 3.7 billion Sm³ to the Netherlands, 6.4 billion Sm³ to Belgium, 2.5 billion Sm³ to

Table I.4.1 Production in million Sm³ oil equivalents.

2001	Production			Consumption of gas			Saleable products			
	Oil	Gas	Cond	Flare	Fuel	Oil	Gas	NGL / Cond	Total	
Balder	3,888	0,211		0,034	0,002	3,888			3,888	
Borg	2,203	0,271					0,207	0,126	0,333	
Brage	2,241	0,306		0,008	0,068	2,229	0,170	0,162	2,561	
Draugen	11,859	0,663		0,005	0,061	11,859	0,276	0,721	12,856	
Ekofisk	15,389	3,006		0,013	0,305	16,580	2,868	0,524	19,972	
Eldisk	1,791	1,221		0,001	0,094	1,988	0,758	0,141	2,887	
Embla	0,432	0,233				0,497	0,082	0,043	0,622	
Frigg		0,738	0,001	0,001	0,012		0,737		0,737	
Frøy	0,033	0,052				0,036	0,042		0,078	
Glitne	0,746	0,039		0,014	0,007	0,746			0,746	
Gullfaks	10,533	3,762		0,106	0,383	10,533	0,845	0,197	11,575	
Gullfaks Sør	3,838	1,469				3,838			3,838	
Gungne		0,860	0,602					0,658	0,658	
Gyda	1,113	0,459		0,001	0,033	1,115	0,234	0,111	1,460	
Heidrun	10,226	2,086		0,040	0,123	10,105	1,339	0,181	11,625	
Heimdal		0,144	0,025	0,009	0,010	0,018	0,225		0,243	
Hod	0,383	0,052				0,377	0,042	0,015	0,434	
Huldra		0,001	0,033			0,039	0,087	0,002	0,128	
Jotun	5,480	0,242		0,004	0,039	5,480	0,199		5,679	
Lille-Frigg		0,000				0,0004			0,0004	
Murchison	0,137	0,015		0,001	0,006	0,139			0,139	
Njord	2,937	2,489		0,012	0,068	2,937			2,937	
Norne	11,380	2,244		0,010	0,159	11,297	1,075	0,197	12,569	
Oseberg I)	12,085	10,689		0,019	0,365	10,970	3,572	0,955	15,497	
Oseberg Sør	4,390	1,077		0,003	0,062	4,456			4,456	
Oseberg Øst	3,820	0,323		0,005	0,033	3,813			3,813	
Sleipner Vest		8,193	3,565	0,013	0,087			3,944	3,944	
Sleipner Øst incl. Loke and saleable gas from Sleipner Vest		7,365	3,813	0,004	0,224		11,647	4,087	15,734	
Snorre	11,624	1,880		0,049	0,126	11,545	0,525	1,019	13,089	
Statfjord	10,126	5,902		0,090	0,406	10,126	1,477	0,620	12,223	
Statfjord Nord	2,838	0,215				2,841	0,116	0,111	3,068	
Statfjord Øst	2,197	0,311				2,197	0,309	0,296	2,802	
Sygna	2,550	0,160				2,550			2,550	
Tambar	0,535	0,124				0,535		0,026	0,561	
Tor	0,235	0,040		0,000	0,008	0,257	0,035	0,009	0,301	
Tordis	2,531	0,244				4,753	0,129	0,137	5,019	
Troll area	19,559	23,036	0,553	0,023	0,228	19,503	21,433	0,640	41,576	
Ula	1,270	0,130		0,003	0,052	1,322	0,006	0,069	1,397	
Valhall	4,304	1,108		0,008	0,085	4,359	0,882	0,215	5,456	
Varg	1,185	0,254		0,004	0,011	1,185			1,185	
Veslefrikk	1,999	0,664		0,014	0,047	1,976	0,066	0,065	2,107	
Vigdis	3,670	0,257				3,670			3,670	
Visund	2,536	1,655		0,009	0,081	2,536			2,536	
Yme	0,125	0,006		0,003	0,003	0,206			0,206	
Åsgard	8,320	10,373		0,045	0,214	8,320	3,805	2,084	14,209	
Total 2001	180,508	94,569	8,592	0,551	3,402	180,824	53,189	17,362	251,375	
Total 2000	181,641	90,266	8,749	0,685	3,267	181,210	49,748	13,498	244,456	
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	

1) Oseberg Vest is included in Oseberg

Spain, 2.4 billion Sm³ to the Czech Republic, 1.2 billion Sm³ to Italy, 0.9 billion Sm³ to Austria and 0.3 billion Sm³ to Poland, cf. Figure 1.5.2.

1.5.2 PRODUCTION ROYALTY

The Norwegian Petroleum Directorate has been delegated the authority to collect 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, the calculation basis applied is in practice 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 to 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 Licence 018.

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

Since, on some fields, oil and NGL are a single product

Figure 1.5.1
Sale of crude oil per country 1992-2001

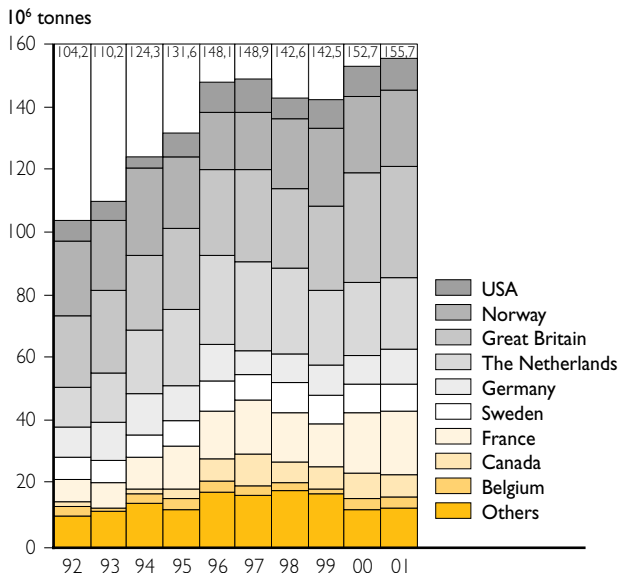
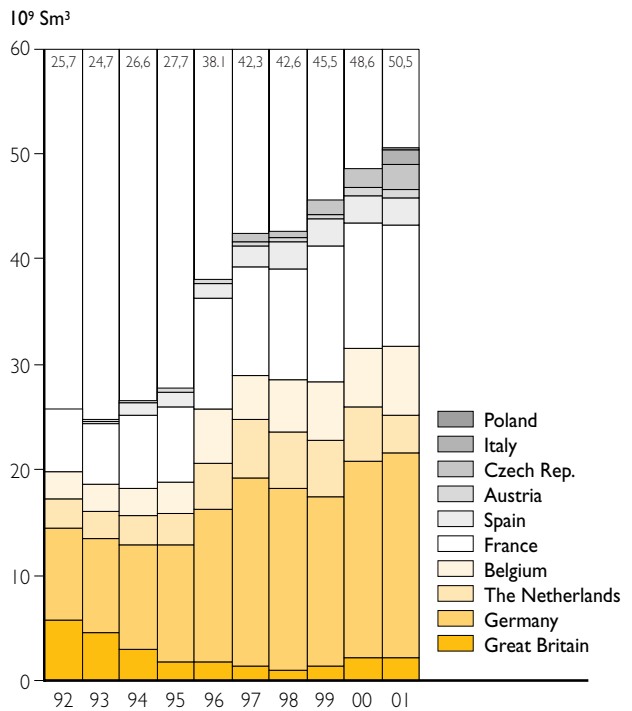


Figure 1.5.2
Sale of gas per country 1992-2001



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.

Total production royalty

In 2001, licensees on the Norwegian shelf paid royalties totaling NOK 2 481 372 503 to the Norwegian Petroleum Directorate. Table 1.5.1 shows the breakdown for the various petroleum products for 2000 and 2001. Figure 1.5.3 shows paid production royalty for the period 1992-2001. In Figure 1.5.4, the paid production royalty in 2000 and 2001 is shown per field.

Figure 1.5.3
Royalties paid 1992-2001

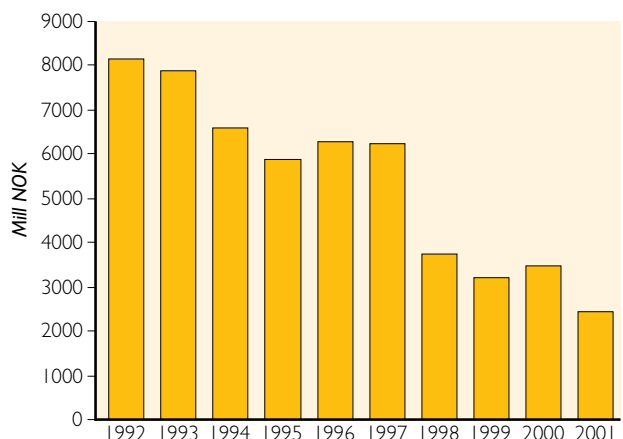


Table 1.5.1 Total paid production royalty in 2000 and 2001 (Million NOK)

Product	Field/area	2000	2001
Oil	Ekofisk area, Ula and Valhall	122,6	0,2
	" Statfjord	1604,8	1058,8
	" Murchison	19,6	0,0
	" Oseberg	1077,9	577,2
	" Gullfaks	639,9	845,7
Total oil		3464,8	2481,9
NGL	Ekofisk area	-5,7	0,1
	" Valhall	1,5	-0,4
	" Ula	2,0	-0,2
	" Murchison	0,9	0,0
Total NGL		-1,3	-0,5
Total oil and NGL		3 463,5	2 481,4

Production royalty on oil

In 2001, NOK 2 481 858 216 was paid in royalties for oil from the Ula, Valhall, Statfjord, Oseberg and Gullfaks fields. This is a reduction of 28 per cent compared with the previous year. The payment from Valhall is due to the recalculation of the royalty for previous years. The production royalty for oil is normally taken out in oil. Sale of the State's royalty oil is handled by Statoil, which makes monthly payments to the Norwegian Petroleum Directorate. Up to and including May 2001, the settlement has taken place according to the norm price stipulated by the Petroleum Price Council. New guidelines were stipulated at that time for calculation of the settlement price for the oil that Statoil takes over from the State, including royalty oil.

The received quantity of royalty oil was reduced by 25 per cent in 2001. On Oseberg and Statfjord, the quantity of royalty oil has been reduced by 43 and 30 per cent respectively, while the quantity of royalty oil on Gullfaks has increased by nearly 44 per cent as a result of the State reducing its direct ownership interest in the field from 73 per cent to 30 per cent. The reduction in quantity is the result of three factors. Firstly, there was a general decline in production in 2001 in those fields which still pay a production

Figure 1.5.4 Royalties paid 2000-2001

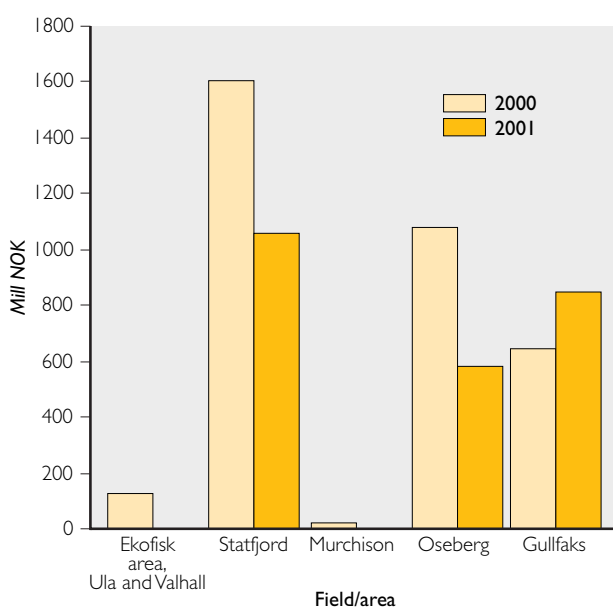


Table 1.5.2 Area fee divided among award years

Area Fee			
Award Year	NOK	Award Year	NOK
1965	36 207 604	1986	74 278 140
1969	27 179 668	1987	13 717 258
1971	3 900 600	1988	90 461 369
1973	38 279 380	1989	16 541 464
1975	14 700 000	1991	39 030 255
1976	51 072 000	1992	1 769 972
1977	7 661 400	1993	76 360 519
1978	29 316 000	1995	9 474 858
1979	98 532 000	1996	10 457 365
1981	24 133 200	1998	4 574 232
1982	32 566 800	1999	5 544 000
1983	66 780 000	2000	13 200 242
1984	130 222 400	2001	5 707 341
1985	93 996 000	Total	1 015 664 067

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. In 2001, the royalty oil was settled at an average price of approximately NOK 226 per barrel, compared with approximately NOK 239 per barrel in 2000.

Production royalty on NGL

In 2001, a net payment of NOK 485 713 was made in relation to production royalty for NGL. This is related to the reim-

Figure 1.5.5 Net area fee paid 1992-2001

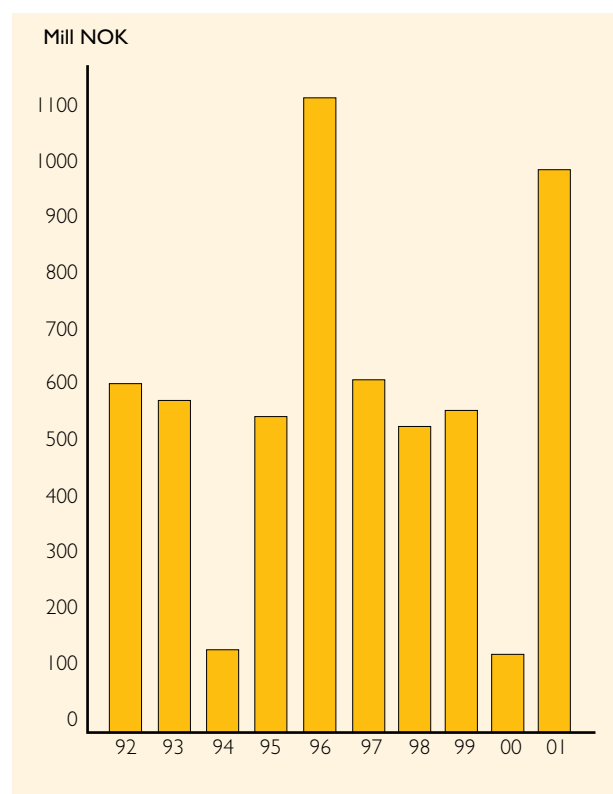
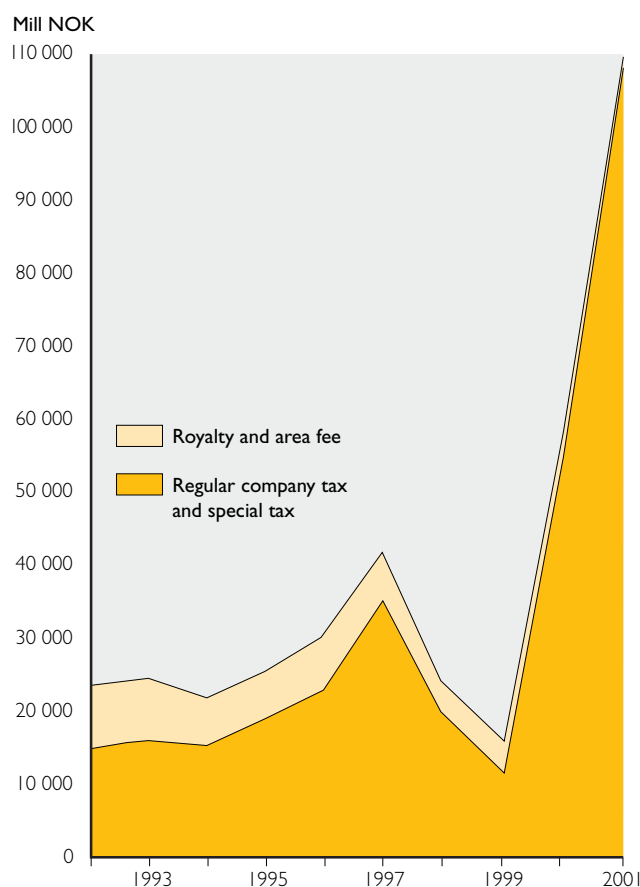


Figure 1.5.6
Total taxes and royalties paid 1992 - 2001



bursment of a total of NOK 574 893 for overpaid royalty from the Valhall and Ula fields in previous years.

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.

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 LICENCES

In 2001, the Norwegian Petroleum Directorate collected NOK 1 015 664 067 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 area fee divided among the award years 1998, 1999, 2000 and 2001 applies to production licences that are partitioned off from existing production licences and awarded as new production licences pursuant to Section 3-10 of the Petroleum Act in these years. The rate of the area fee follows the original production licence.

The Norwegian Petroleum Directorate has refunded NOK 33 064 307 in area fees in 2001. This represents the deductible portion of the area fee in the royalty settlement for production licences 019A, 019B, 037, 050, 053 and 079.

Figure 1.5.7
CO₂ tax paid 1992-2001

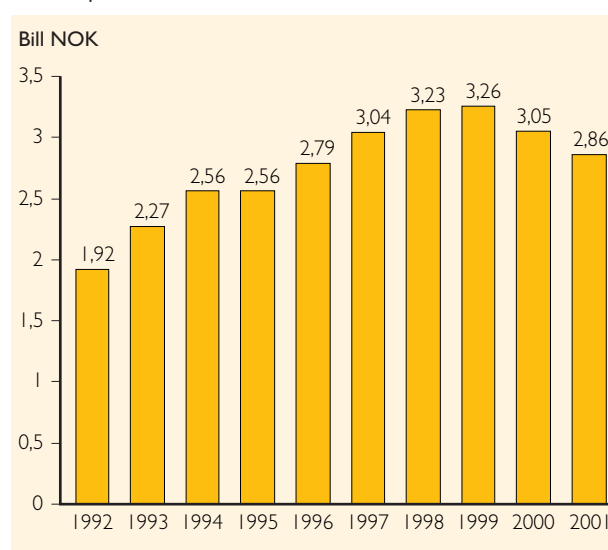
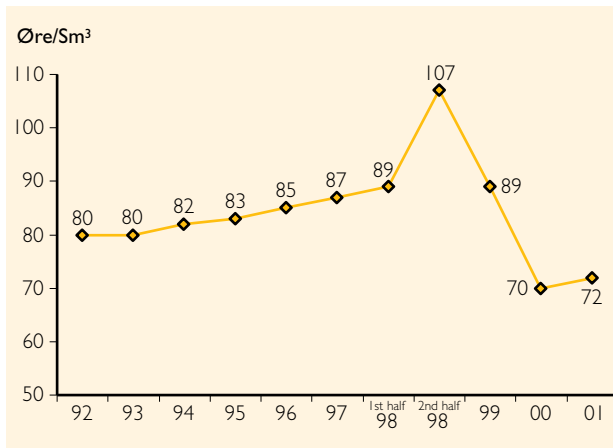


Figure 1.5.5 shows the net area fee receipts for 1992 - 2001. There is an increase of more than NOK 860 million in 2001 as compared with 2000. The reason for this is that, in accordance with the 1972 decree and the Petroleum Act, production licences could delay the payment date from 31 December 2000 to 2 January 2001 due to the holiday. In addition, the area fee for 2002 was paid as per 31 December 2001.

Tabell 1.5.3 CO₂ tax paid in 2001

Field	First half-year	Second half-year	Total 2001
Balder	58 179 286	25 467 798	83 647 084
Brage	25 146 100	25 994 160	51 140 260
Draugen	25 766 968	24 745 750	50 512 718
Ekofisk area	153 431 276	159 879 799	313 311 075
Frigg area	8 064 606	6 292 987	14 357 593
Gullfaks A, B and C	145 152 078	171 072 944	316 225 022
Gyda	11 407 313	13 130 438	24 537 751
Heidrun	48 295 535	55 591 325	103 886 860
Heimdal	1 463 000	7 334 640	8 797 640
Hod	62 790	72 396	135 186
Jotun	15 404 088	15 110 060	30 514 148
Murchison	5 834 219	5 439 807	11 274 026
Njord A and B	27 579 300	32 299 200	59 878 500
Norne	57 594 148	63 362 043	120 956 191
Oseberg A, B, C and D	137 604 600	135 585 360	273 189 960
Oseberg Sør	20 328 000	23 472 720	43 800 720
Oseberg Øst	14 389 200	13 641 120	28 030 320
Sleipner	104 004 180	110 370 572	214 374 752
Snorre A and B	37 700 870	59 148 720	96 849 590
Statfjord A, B and C	175 257 012	175 737 099	350 994 111
Troll A	261 793	323 129	584 922
Troll B	44 986 900	47 581 920	92 568 820
Troll C	33 779 200	42 441 120	76 220 320
Ula	19 603 812	21 594 338	41 198 150
Valhall	34 355 756	36 378 667	70 734 423
Varg	11 322 500	7 704 720	19 027 220
Veslefrikk	30 696 456	24 719 190	55 415 646
Visund	32 635 400	33 020 640	65 656 040
Yme	15 644 411	9 189 573	24 833 984
Åsgard A, B and C	81 498 295	124 047 191	205 545 486
Transportation systems			
Norpipe	5 129 643	3 864 472	8 994 115
Statpipe	2 093 533	2 271 401	4 364 934
Total	1 384 672 268	1 476 885 299	2 861 557 567

Figure 1.5.8
 Tax rate for CO₂ (øre/Sm³)


Production royalties and area fees in 2001 accounted for three per cent of the total taxes and fees paid from the petroleum activities. The proportion of the fees has varied over time. The highest proportion was in 1989 at 53 per

cent. Figure 1.5.6 shows total taxes and royalties paid for 1992-2001.

1.5.4 CO₂ TAX

The Act of 21 December 1990 No. 72 relating to tax on emission of CO₂ 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 CO₂ tax and to make administrative decisions necessary to enforce the Act. The tax is calculated on petroleum flared and natural gas or pure CO₂ released to the atmosphere from installations used in connection with production or transportation of petroleum. The CO₂ 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 CO₂ tax is only calculated on the Norwegian share.

In the second half of 2000 and the first half of 2001, the CO₂ tax was fixed at NOK 0.70 and 0.72 per Sm³ gas and NOK 0.70 and 0.72 per liter diesel. The tax is paid on a six-month basis with a three-month term of payment (as of 1

Table 1.6.1 Licences for scientific exploration for natural deposits

Licence	Name	Field of work			Area
		Geo-physics	Geo-logy	Other	
350/2001	Institut für Meereskunde an der Universität Kiel			Marine biology	North Sea, Skagerrak
351/2001	University of Bergen	x			Norskerenna
352/2001	Gothenburg University			Hydrography	Skagerrak
353/2001	IFREMER, France		x	Oceanography	Norwegian Sea, Greenland Sea
354/2001	British Geological Survey	x			Norwegian Sea, North Sea
356/2001	University of Tromsø	x	x		Ullsfjorden, Balsfjorden
357/2001	University of Tromsø	x	x		Norwegian Sea, Andfjorden, Vestfjorden
358/2001	Alfred Wegener Institut für Polar- und Meeresforschung		x	Oceanography, chemistry, marine biology	Greenland Sea
359/2001	Alfred Wegener Institut für Polar- und Meeresforschung		x	Oceanography, marine biology	Nansen basin, Gakkel ridge
360/2001	Bundesamt für Seeschifffahrt und Hydrographie			Oceanography, geochemistry	Skagerrak
361/2001	Bundesamt für Seeschifffahrt und Hydrographie			Hydrography, marine biology	North Sea
362/2001	Netherland's Institute for Sea Research			Marine biology	North Sea, Skagerrak
363/2001	Alfred Wegener Institut for Polar- and Marine Research			Oceanography, geochemistry	Svalbard / Greenland Sea
364/2001	Institut für Meereskunde an der Universität Kiel			Geochemistry	Skagerrak
365/2001	Gothenburg University			Geochemistry	Skagerrak
366/2001	MAFF/CEFAS Fisheries Laboratory UK			Marine biology	North Sea
367/2001	University of Tromsø	x	x		Svalbard / Greenland Sea
368/2001	Institut für Meereskunde an der Universität Kiel			Geochemistry	Skagerrak
369/2001	University of Tromsø	x	x		Svalbard, Knipovich ridge
370/2001	Bundesanstalt für Landwirtschaft und Ernährung			Marine biology	North Sea
371/2001	Belgian Ministry for Science Policy			Marine biology	North Sea
372/2001	United States Coast Guard			Oceanography	Svalbard
373/2001	Netherland's Institute for Sea Research			Marine biology	North Sea, Skagerrak
374/2001	University of Tromsø	x	x		Fugløysundet, Stjærnsund, Ytre Andfjorden

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 2001. The tax is broken down by the individual fields and transportation systems. New fields/installations subject to the tax are Njord B, Oseberg Sør and Snorre B. Corrections relating to previous six-month periods are included. A total of NOK 2 861 557 567 in CO₂ tax was paid in 2001. Figure 1.5.7 shows the yearly receipts of CO₂ tax for 1991-2001, and Figure 1.5.8 shows changes in the tax rate.

1.6. EXPLORATION LICENCES

1.6.1 LICENCES TO EXPLORE FOR PETROLEUM

As of 31 December 2001, a total of 277 exploration licences have been awarded. Such licences are awarded in accordance with the Petroleum Act and have a duration of three years. The following licences were awarded in 2001:

Company	
GECO.A.S	268
TotalFinaElf Exploration Norge AS	269
Den norske stats oljeselskap a.s	270
BP Amoco Norge AS	271
Enterprise Oil Norge Ltd	272
CGG Marine	273
InSeis AS	274
Veritas DGC Limited	275
RWE-DEA Norge AS	276
Kerr-McGee Norway AS	277

1.6.2 LICENCES FOR SCIENTIFIC EXPLORATION

As of 31 December 2001, a total of 374 licences for scientific exploration have been awarded on the Norwegian sector of the continental shelf. Twenty-five such licences were awarded in 2001, see Table 1.6.1. One survey was not carried out.

1.7 EXPLORATION ACTIVITIES

1.7.1 GEOPHYSICAL SURVEYS

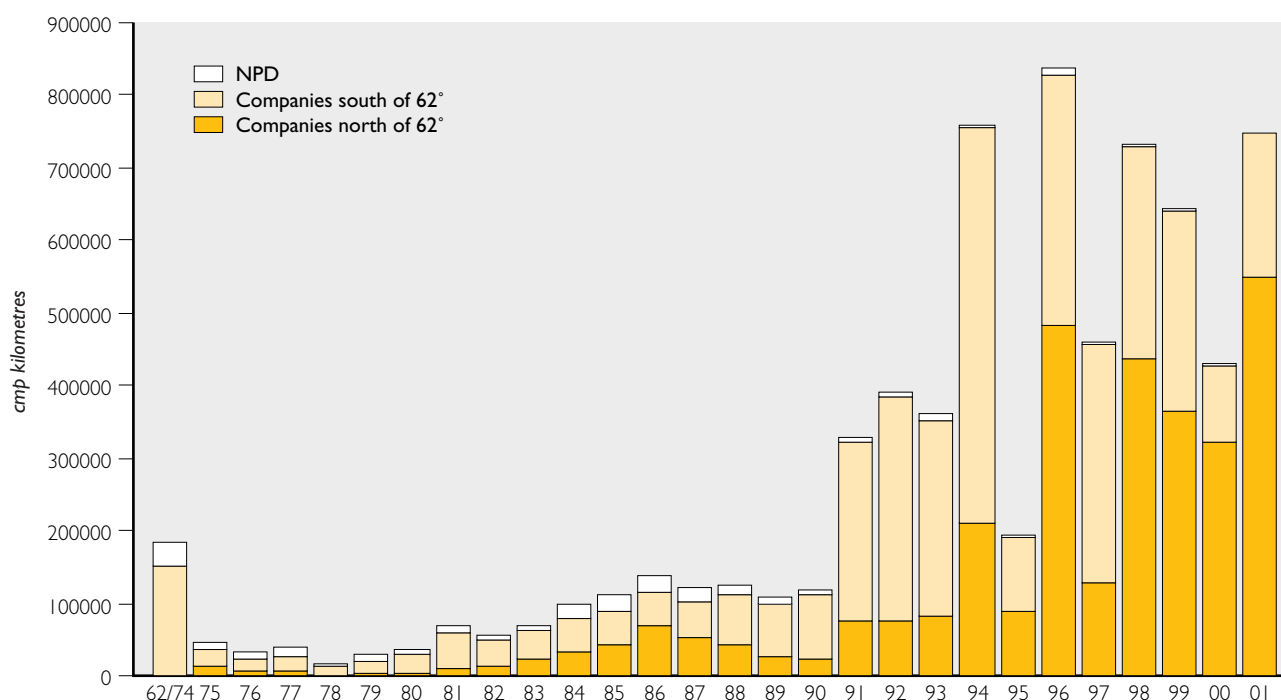
A total of 748 913 km of seismic data were acquired on the Norwegian shelf in 2001. The number of kilometers refers to cmp-line kilometers.

In the North Sea, a total of 197 784 km of seismic data were acquired, in addition to 529 630 km in the Norwegian Sea and 21 499 km in the Barents Sea.

The Norwegian Petroleum Directorate acquired 1 149 km of seismic data, while oil companies, seismic contractors and universities collected 747 764 km. Of this total, Norwegian oil companies acquired 224 455 km and foreign oil companies acquired 172 536 km. The contractor companies CGG, Fugro Geoteam, Inseis, TGS-NOPEC, PGS and WesternGeco acquired 350 773 km for their own accounts.

Of the total seismic data acquired, 3D seismic accounts for 729 249 km: 196 856 km in the North Sea, 522 211 km in the Norwegian Sea and 10 182 km in the Barents Sea. Figure 1.7.1 illustrates the development with regard to the number of cmp-line kilometers acquired.

Figure 1.7.1
Seismic acquisition on the Norwegian continental shelf 1962 - 2001



1.8 PRODUCTION LICENCES

On 27 April 2001, six production licences were awarded in the North Sea in the North Sea Award 2000. Two of the awards took the form of seismic areas. The production licences cover seven blocks or parts of blocks, and the seismic area covers eight blocks.

There have also been five partitions in existing production licences. These were Production Licence 029B (additional acreage to the Glitne field), 033B (addition to the Valhall field), 048B (partition from the Glitne field), 052B (addition to the Huldra field) and 072B (partition from the Sigyn field).

1.9 EXPLORATION ACTIVITY

1.9.1 EXPLORATION DRILLING

At the turn of the year 2000/2001, drilling of three exploration wells was in progress.

Thirty-four exploration wells were spudded in 2001, of which 25 were wildcats and nine were appraisal wells. The drilling activity in 2001 has been divided among 15 wildcat and two appraisal wells in the North Sea, eight wildcat and five appraisal wells in the Norwegian Sea and two wildcat and two appraisal wells in the Barents Sea. In addition, five temporarily abandoned exploration wells were re-entered for permanent plugging; four in the North Sea and one in the Norwegian Sea.

At the end of 2001/beginning of 2002, eight exploration wells were being drilled, so that 29 exploration wells were completed in 2001.

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

The operators for the wells completed or temporarily

abandoned in 2001 were as follows: Statoil 12, Norsk Hydro ten, BP Amoco two, Conoco two and Esso, Chevron and Agip one each. Regional distribution is shown in Figure 1.9.1. Completed exploration wells are shown in Table 1.9.1. As of 31 December 2001, a total of 1022 exploration wells had been spudded on the Norwegian continental shelf. These are divided between 733 wildcat wells and 289 appraisal wells, see Figure 1.9.2.

A total of 79 exploration wells have been reclassified on the Norwegian continental shelf, 73 of these from wildcat to appraisal wells and six from appraisal to wildcat wells.

As of 31 December 2001, 1014 exploration wells were completed or temporarily abandoned on the Norwegian shelf. After reclassification, these comprise 658 wildcat and 356 appraisal wells.

As of year-end, a total of 53 exploration wells have been temporarily abandoned on the Norwegian shelf.

The temporarily abandoned exploration wells are listed in Table 1.9.2.

New discoveries 2001

Twelve new discoveries were made on the Norwegian shelf during 2001, see Table 1.9.3. One discovery was made in the Barents Sea, four in the Norwegian Sea and seven in the North Sea. Based on the number of completed wildcat wells (21), this gives a discovery rate of 57 percent.

Detailed description of drilling in 2001 The North Sea

Eighteen exploration wells were drilled in the North Sea in 2001, of which one was spudded in 2000 and four were not yet completed at year-end, see Figures 1.9.3 and 1.9.4.

Appraisal well 15/3-7 on the Gudrun discovery proved oil in Upper Jurassic rocks and traces of hydrocarbons in rocks from the Middle Jurassic Age.

Figure 1.9.1
Regional spread of exploration wells per operator 1965-2001

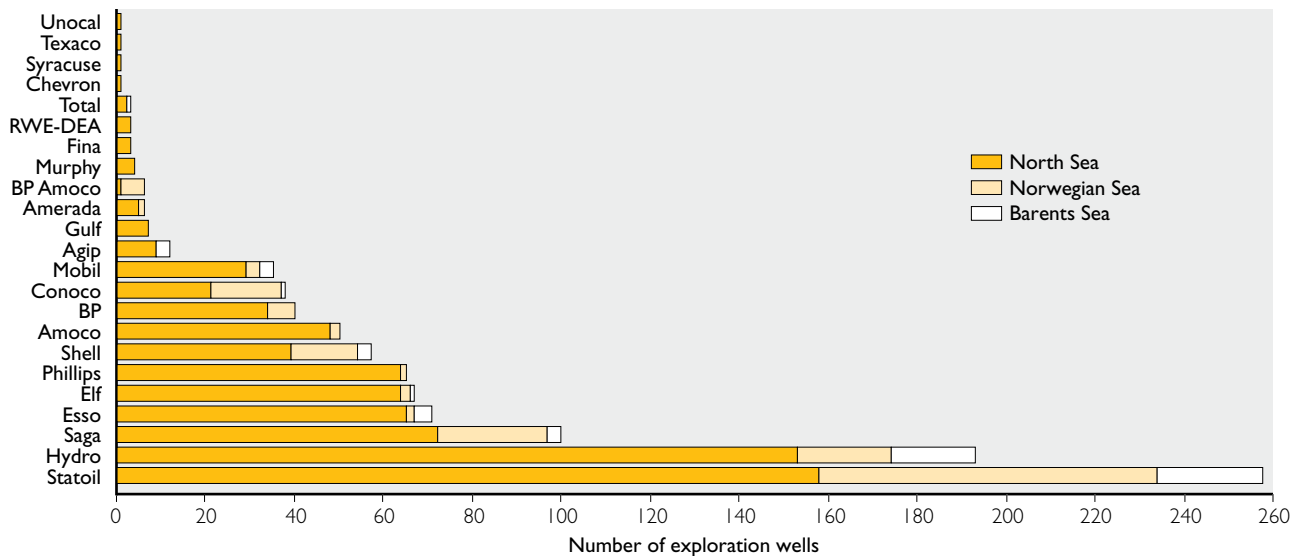
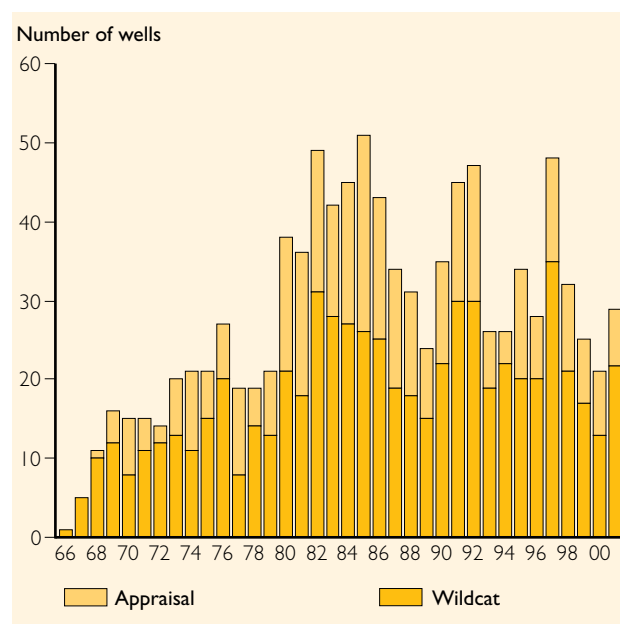


Table I.9.1 Exploration wells completed in 2001

Exploration well	Well classification	Production licence	Operator	Total vertical depth m (MSL)	Total depth (age)	Status (31 Dec 2001)
15/3-7	appraisal well	025	Statoil	4818	Jurassic	dry
15/12-12	wildcat well	038	Norsk Hydro	3085	Triassic	oil/gas
16/2-2	wildcat well	265	Statoil	1855	Cretaceous	dry
24/12-4	wildcat well	204	Statoil	2265	Tertiary	dry
25/2-16 S	wildcat well	244	Norsk Hydro	4013	Early Jurassic	dry
25/8-13	wildcat well	027 B	Esso	2258	Jurassic	dry
30/6-26	wildcat well	053	Norsk Hydro	2860	Jurassic	oil
30/6-27	wildcat well	053	Norsk Hydro	3432	Jurassic	oil
34/7-31	wildcat well	089	Norsk Hydro	2650	Late Jurassic	oil
34/7-31 A	appraisal well	089	Norsk Hydro	3454	Jurassic	dry
34/7-32	wildcat well	089	Norsk Hydro	2651	Jurassic	dry
34/8-12 S	wildcat well	120	Norsk Hydro	3160	Triassic	oil
34/10-43 S	wildcat well	050 B	Statoil	5725	Early Jurassic	oil
34/10-44 S	wildcat well	050	Statoil	4865	Triassic	oil
6305/9-1	wildcat well	252	Norsk Hydro	2655	Cretaceous	dry
6406/1-1	wildcat well	257	Statoil	5057	Early Jurassic	gas/cond
6506/3-1	wildcat well	259	Chevron	3662	Cretaceous	dry
6506/11-7	wildcat well	134	Statoil	4972	Early Jurassic	oil/gas
6507/5-4	appraisal well	212	BPAmoco	3814	Jurassic	dry
6507/5-4 A	appraisal well	212	BPAmoco	3858	Jurassic	dry
6507/7-13	wildcat well	095	Conoco	2623	Jurassic	oil
6507/7-13 A	appraisal well	095	Conoco	2623	Jurassic	dry
6507/11-6	wildcat well	263	Norsk Hydro	3440	Early Jurassic	gas/cond
6608/10-7	appraisal well	128	Statoil	2319	Jurassic	dry
7121/5-3	wildcat well	110	Statoil	2265	Triassic	dry
7122/7-2	appraisal well	229	Norsk Agip	1418	Triassic	dry
7228/7-1 S	wildcat well	202	Statoil	2071	Permian	dry
7228/7-1 A	wildcat well	202	Statoil	2881	Triassic	oil/gas
7228/7-1 B	appraisal well	202	Statoil	2227	Triassic	dry

 Figure I.9.2
 Exploration wells completed per year after reclassification


Appraisal well 15/12-12 proved oil and gas in the Rev prospect south of the Varg field in Production Licence 038. Development is likely, but not yet resolved.

Exploration well 16/2-2 south of the Grane and Balder fields with target in Tertiary rock was dry.

Exploration well 24/12-4 west of the Grane and Balder fields with target in Tertiary rock was also dry.

Exploration well 25/2-16 S southwest of 25/2-5 Lille Frøy with target in Jurassic rock was dry.

Exploration well 25/8-13 southeast of the Jotun field with drilling targets in Tertiary rock was dry.

Two exploration wells on the west flank of Oseberg, 30/6-26 on Gamma Vest and 30/6-27 on Kappa Nord, discovered oil and gas. The discoveries are assessed as encouraging and will be included in plans for further development of the area.

Exploration well 34/7-31 and appraisal well 34/7-31 A were drilled on the Borg Nord prospect south of Snorre in Production Licence 089. Both wells proved oil in sandstone from the Late Jurassic Age, thus confirming a northern extension of the reservoir sandstones at Borg. The 34/7-31 Borg Nord discovery is included in the planned development of the central area between the Vigdis, Stafjord Øst and Tordis fields.

Table 1.9.2 Temporarily abandoned exploration wells

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

Exploration well 34/7-32, just northwest of the Vigdis field, was drilled in a separate fault block to Jurassic rocks. This well was dry.

Exploration well 34/8-12 S was drilled in a structure between the Visund and Gullfaks fields. The well discovered oil/condensate in two separate layers in rocks from the Middle and Early Jurassic Ages respectively. The discovery was not tested, but is regarded as being promising for future exploration in adjacent and nearby structures. Development may be relevant if further exploration shows that the deposit has a larger extension.

Statoil has made two oil/condensate discoveries in the Gullfaks area. Exploration well 34/10-43 S was drilled on a

separate Jurassic structure near Gullfaks Sør. The well proved only small quantities of oil in the Statfjord formation, but did nevertheless provide valuable information for further exploration in the area. Exploration well 34/10-44 S was drilled as an extension of a production well in the Rimfaks deposit to the deeper Lunde formation from the Triassic Age. Oil and gas condensate were proven. The discovery represents interesting additional resources for Gullfaks Sør.

The Norwegian Sea

Fourteen exploration wells were drilled in this area in 2001, of which one was spudded in 2000 and four were not yet completed at year-end.

Exploration well 6305/9-1 was drilled in Production Licence 252 southeast of 6305/5-1 Ormen Lange. The well was completed in rocks from the Late Cretaceous Age, and was dry.

Exploration well 6406/1-1 in Production Licence 257 was drilled on the northern part of a structure called the Erlend structure, just west of the Kristin field. The well was completed in Jurassic rocks and proved small quantities of gas/condensate under high pressure in Early Jurassic sandstone. Gas and condensate have previously been proven in the eastern part of the structure.

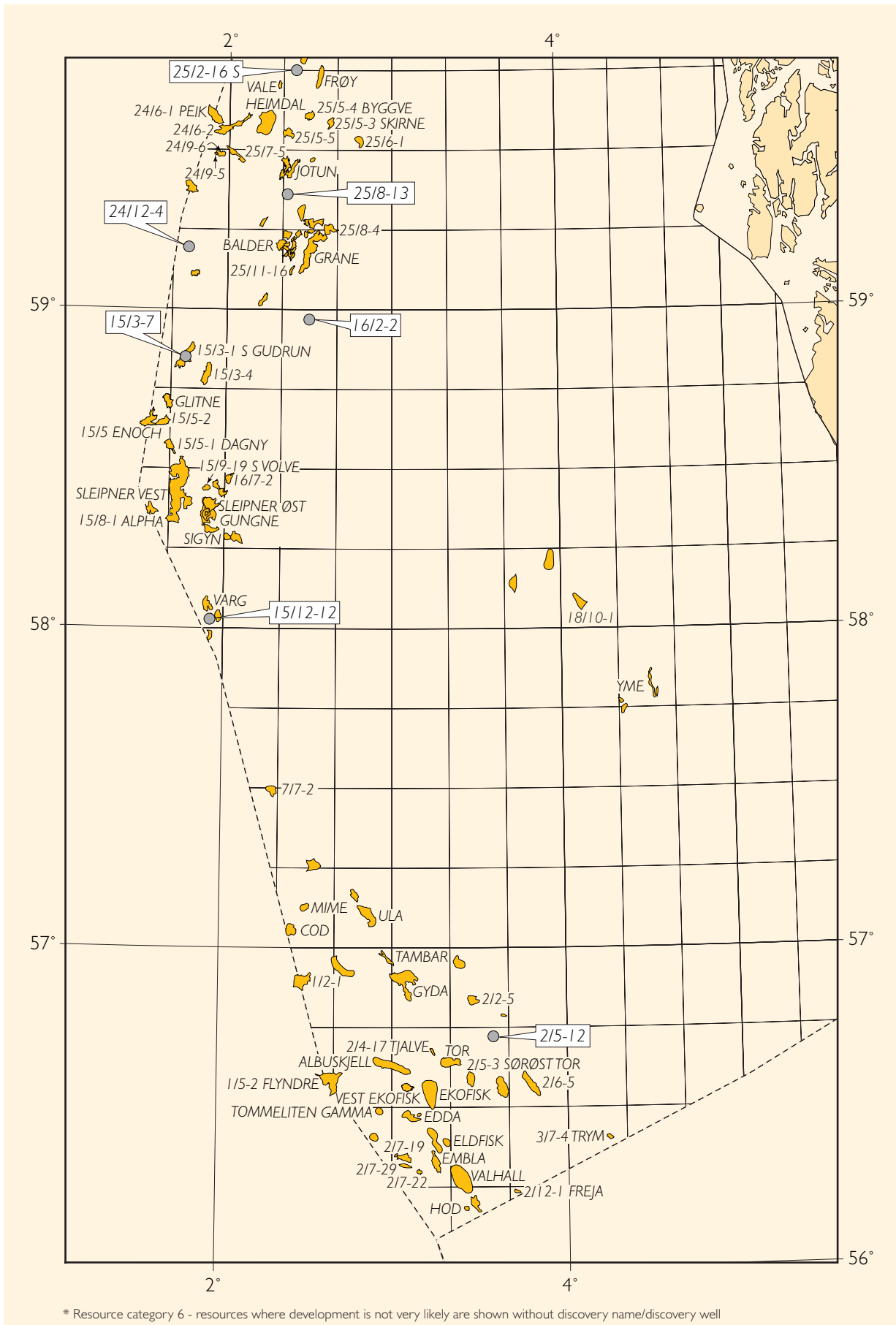
Exploration well 6506/3-1 in Production Licence 259 encountered only traces of gas. The well, which is located west of 6507/5-1 Skarv, has provided important geological data in a less-explored area of the Norwegian Sea. The production licence was awarded in the 16th Licensing Round in the spring of 2000.

Exploration well 6506/11-7 in Production Licence 134 B was drilled on a structure just north of the Kristin field. The

Table 1.9.3 New discoveries 2001

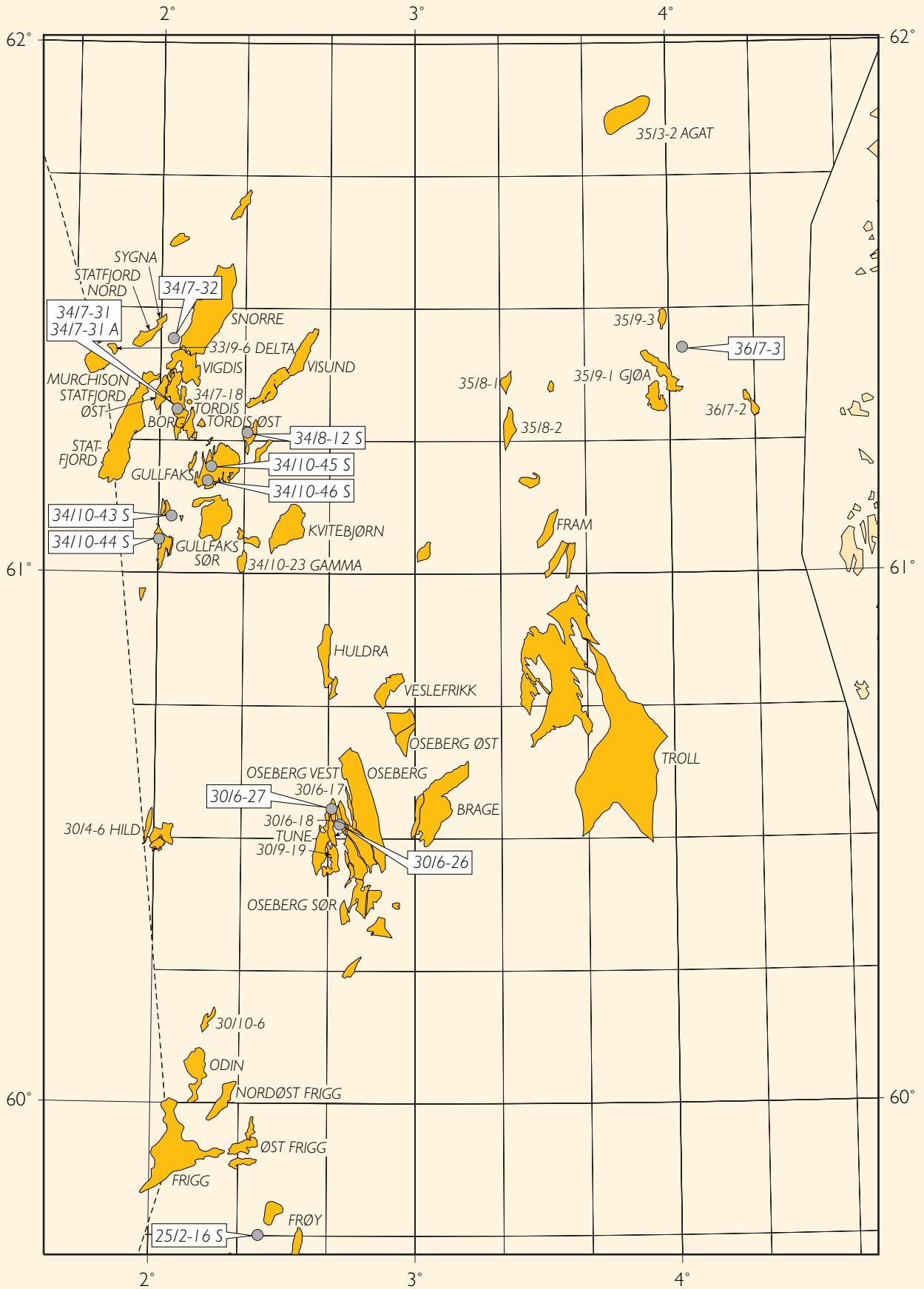
Well	Operator	Hydrocarbon type	Reservoir level (Age)	Discovery size (recoverable resources)	
				Oil/ condensate million Sm ³	Gas billion Sm ³
6506/11-7	Statoil	oil/gas	Jurassic	6,4	3,1
15/12-12	Norsk Hydro	oil/gas	Late Jurassic	6-7	2-3
34/7-31	Norsk Hydro	oil	Late Jurassic	6	
30/6-26	Norsk Hydro	oil	Jurassic	3,85	1,8
7728/7-1A	Statoil	oil/gas	Triassic	<1	5-10
6507/11-6	Norsk Hydro	gas/cond.	Middle Jurassic	0,6	3,7
34/8-12 S	Norsk Hydro	oil	Middle Jurassic	<1	<1
		oil	Early Jurassic	2	
6507/7-13	Conoco	oil	Jurassic	1-2	
30/6-27	Norsk Hydro	oil	Jurassic	1-2	
6406/1-1	Statoil	gas/cond.	Late Jurassic	<1	1,3
34/10-44 S	Statoil	oil	Triassic	0,73	
34/10-43 S	Statoil	oil	Early Jurassic	0,25	

Figure 1.9.3
Exploration wells in the southern North Sea spudded or completed during the year



* Resource category 6 - resources where development is not very likely are shown without discovery name/discovery well

Figure 1.9.4
Exploration wells in the northern North Sea spudded or completed during the year



* Resource category 6 - resources where development is not very likely are shown without discovery name/discovery well

Figure 1.9.5
Exploration wells in the Norwegian Sea spudded or completed during the year

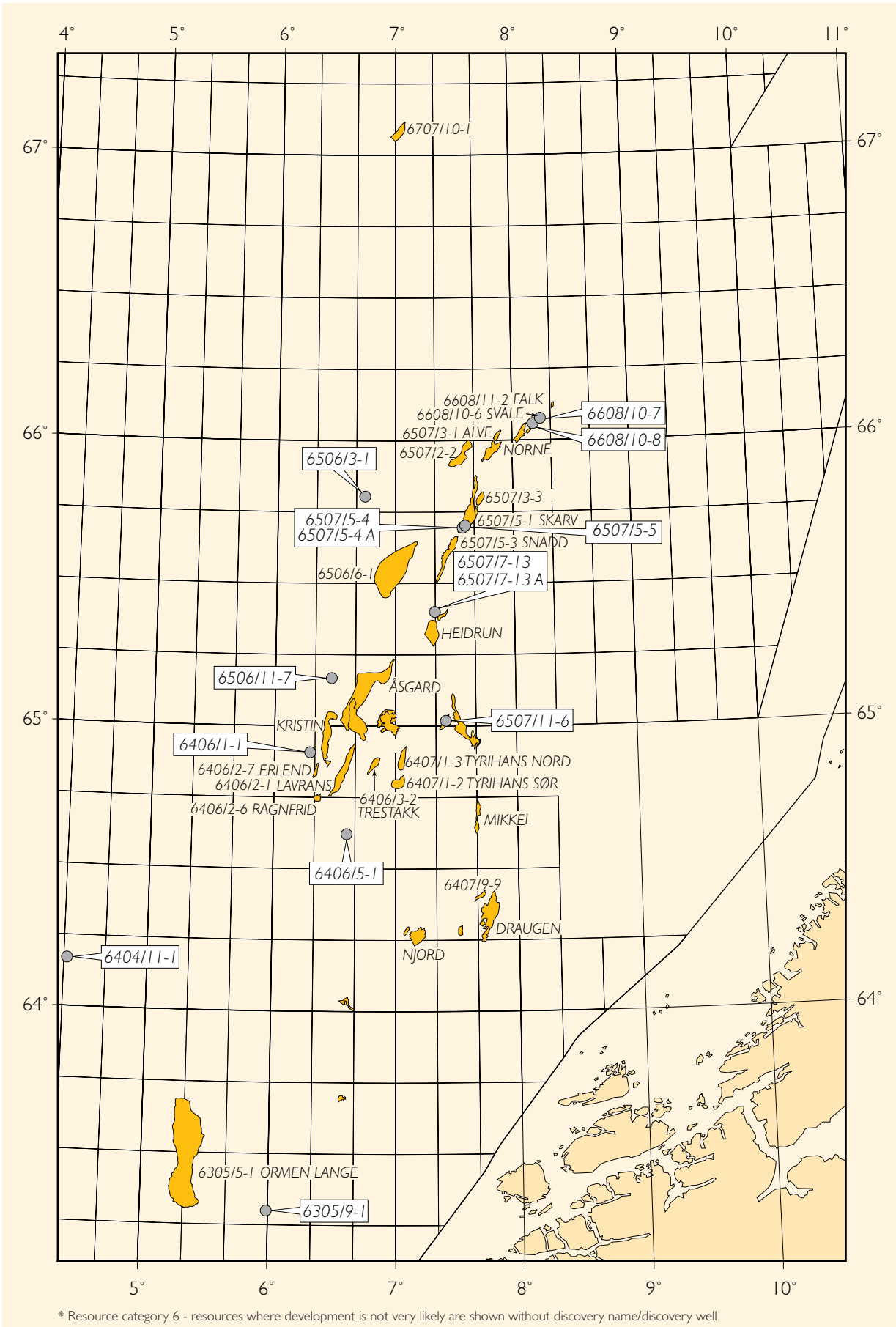
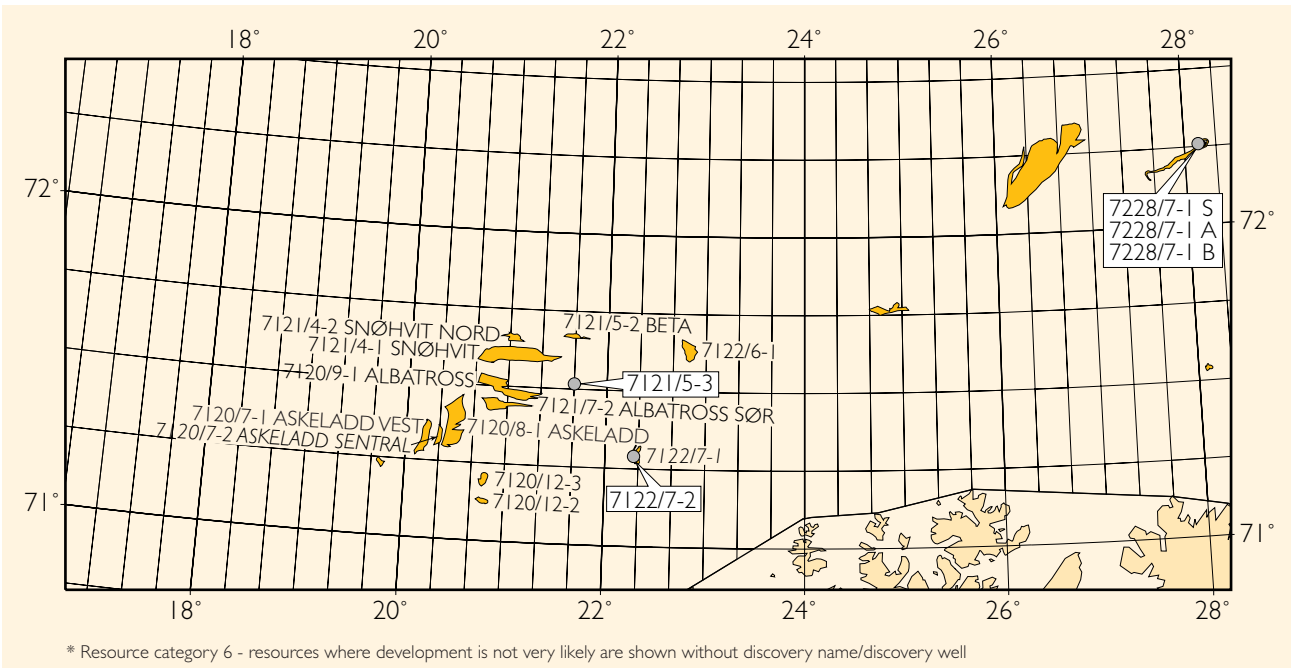


Figure 1.9.6
Exploration wells in the Barents Sea spudded or completed during the year



well, which was formation-tested, proved oil under high pressure in Jurassic sandstone.

Two appraisal wells were drilled on 6507/5-1 Skarv in Production Licence 212, Blocks 6507/5 and 6, 6507/5-4 and the sidetrack 6507/5-4 A. The blocks in the production licence are located about 200 km west of Sandnessjøen. Well 6507/5-4 proved oil and gas in sandstone layers from the Jurassic and Cretaceous Ages. Sidetrack 6507/5-4 A was drilled to prove additional recoverable resources in Jurassic sandstones down flank from the vertical well. The well proved oil in rocks from the Jurassic Age.

Exploration well 6507/7-13, spudded in 2000, and appraisal well 6507/7-13A proved oil in Early Jurassic rocks in a small structure north of Heidrun. The discovery may be developed via Heidrun.

Exploration well 6507/11-6 in Production Licence 263 was drilled on a structure just west of 6507/11-1 Midgard. The well proved gas and condensate in sandstone from the Middle Jurassic Age, and was completed in Early Jurassic rock.

Appraisal well 6608/10-7 in Production Licence 128 was drilled on 6608/10-6 Svale. 6608/10-6 Svale was proven in 2000 and lies approx. 10 km northwest of the Norne field. The well proved oil in sandstones from the Jurassic Age. An attempt was made to test the well, but the test was aborted due to technical problems. However, extensive logging and core sampling was carried out on the well. The appraisal well led to a downward adjustment of the oil resources in 6608/10-6 Svale due to less reservoir sand and more water than expected.

Barents Sea

Five exploration wells were drilled in the Barents Sea in 2001, one of which was spudded in 2000. Three of the wells

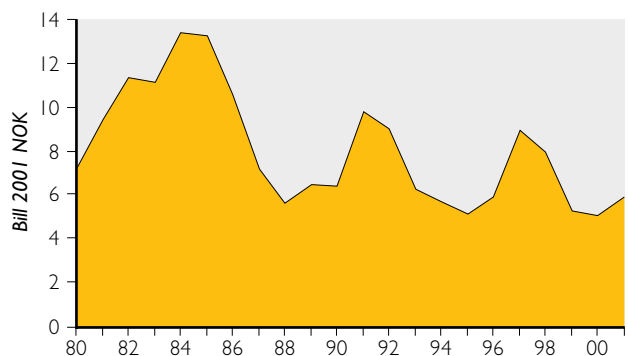
were wildcat wells, while two were appraisal wells, see Figure 1.9.6.

Exploration wells 7228/7-1 S and 7228/7-1 A, as well as appraisal well 7228/7-1 B, were drilled within Production Licence 202 in the North Cape Basin about 130 km northwest of the North Cape. The purpose of the wells was exploration for hydrocarbons in sandstones from the Jurassic and Triassic Ages. Smaller quantities of oil and gas were proven in Triassic rocks. The wells were completed in Early Triassic rocks.

Exploration well 7121/5-3 S was drilled in Production Licence 110 in the Hammerfest Basin to look for hydrocarbons in sandstones from the Middle Jurassic Age. The well was completed in Triassic rocks and was dry. The well yielded important information for further evaluation of the area.

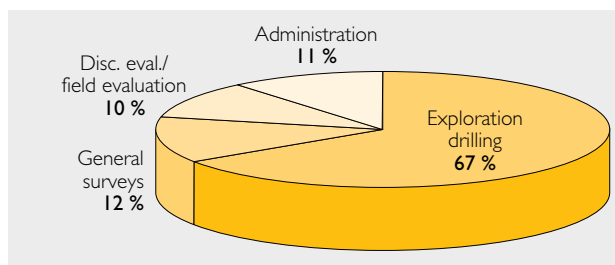
Appraisal well 7122/7-2 in Production Licence 229 was drilled on 7122/7-1 Goliat, southeast of 7121/4-1 Snøhvit. The well was completed in rocks from Triassic Age. An oil

Figure 1.9.7
Annual exploration and planning costs



column of more than 70 meters was proven in sandstones from the Jurassic/Triassic Ages. The well was formation tested. The result of the appraisal well was positive and will be included in the further evaluation of the discovery with a view towards a development.

Figure 1.9.8 Percentage distribution of exploration cost for 2001



1.9.2 EXPLORATION COSTS

Thirty-four exploration wells were spudded in 2001, of which eight were still being drilled at year-end. Of these, 25 were wildcats and nine were appraisal wells. This is an increase of ten exploration wells compared with 2000. During the period from 1996 through 2001, the number of spudded wildcat and appraisal wells has averaged 20 and eight respectively.

Figure 1.9.7 shows exploration costs from and including 1980. The costs include the costs of exploration drilling, general surveys, evaluation of discoveries, field development and administration and other costs. Total exploration costs from 1980 through 2001 amounted to 174 billion 2001-NOK.

Table 1.9.4 shows the exploration costs for 2001 in total and for the four cost groups. Figure 1.9.8 shows the percentage distribution among the cost groups.

In 2001, the share of exploration costs related to exploration drilling was 67 percent, while the corresponding figure for 2000 was 58 percent. Expenses related to general surveys constituted 12 percent in both 2001 and 2000.

Figure 1.9.9 shows average drilling costs per exploration well. In 2001, NOK 3.97 billion worth of drilling was carried out and the drilling cost per exploration well is estimated at

Figure 1.9.9 Average drilling cost per exploration well

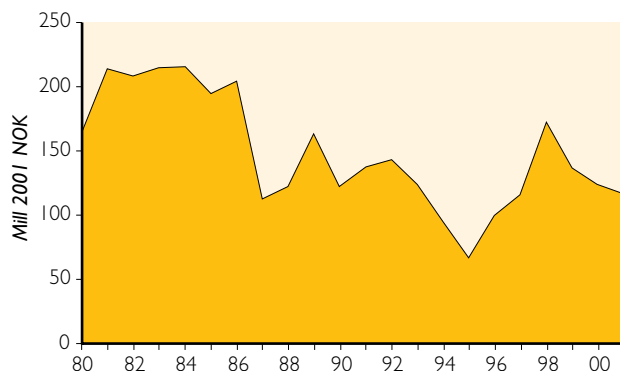
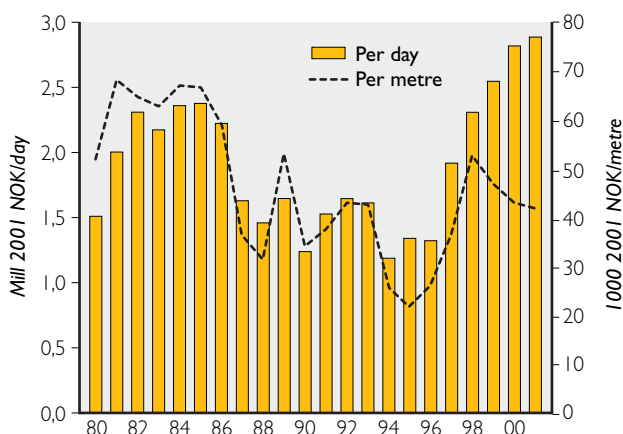


Figure 1.9.10 Average drilling cost per day and per metre drilled in 1980-2001



NOK 117 million. The drilling cost per exploration well in 2000 was 124 million 2001-NOK. In 1998, the drilling cost per exploration well amounted to 173 million 2001-NOK.

Figure 1.9.10 shows the average drilling cost per day and per meter drilled in the years 1980 through 2001 inclusive. Since 1998, drilling cost per meter has declined, although the drilling cost per day has increased.

Table 1.9.4 Exploration costs distributed by cost groups

Cost groups	Million NOK
Exploration drilling	3970
General surveys	733
Discovery evaluation / field development	610
Administration and other costs ¹	686
Total	5999

¹ Administration and other costs include area fees

1.10 DEVELOPMENT AND OPERATIONS

Factual information about fields and discoveries mentioned in the area descriptions are located on the Norwegian Petroleum Directorate's website: www.npd.no. Descriptions of fields, etc. may also be found in Facts 2002: www.oed.dep.no, published by the Ministry of Petroleum and Energy.

1.10.1 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, 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. A major gas injection study for Ula and Gyda was started in 2001. The potential for measures such as gas injection to increase the recoverable reserves in Ula led to an extension of the Ula production licence to 2028.

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 now a part of the Gyda field.

Tambar started production in the summer of 2001. The field has a simple development concept consisting of a normally unmanned installation with remote control from and processing on Ula.

The gas from Tambar is used for alternating water and gas injection in Ula, thus increasing production and lifetime for Ula. A gas pipeline was laid between Ula and Gyda in 2001. This will increase flexibility and provide additional opportunities for gas injection in the Ula reservoir, as well as provide export opportunities for the reproduced gas.

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 has been 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 contains 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 latter 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 in the Ekofisk area to evaluate future infrastructure needs. 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 and production. It is expected that a plan for the first stage of this process will be submitted to the authorities towards the end of 2002.

Geological time scale

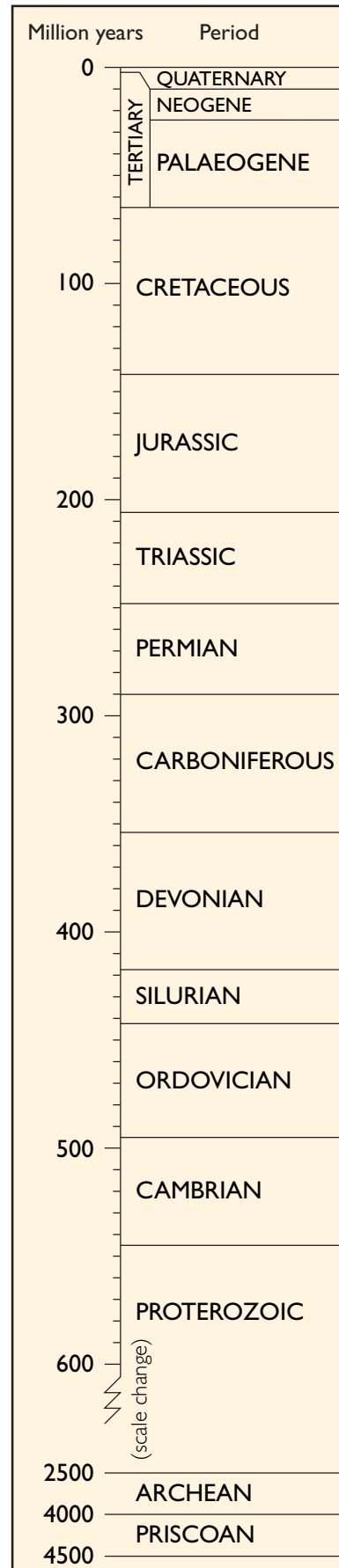
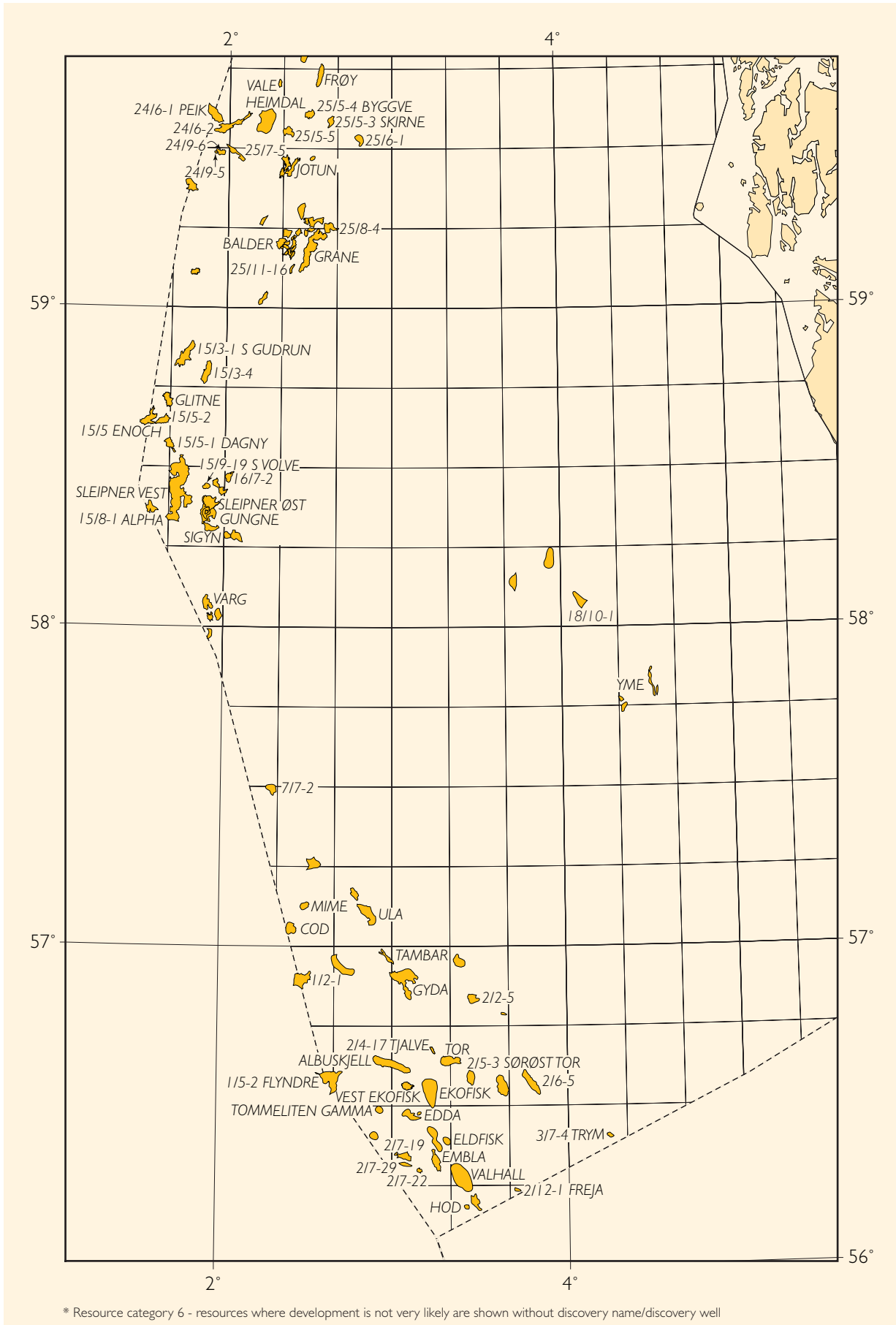


Figure I.10.1
Fields and discoveries in the southern North Sea (Resource category 1-5) *



The Valhall area comprises the Valhall and Hod fields. The reservoirs consist of limestone rocks from the Early Paleocene to the Late Cretaceous Ages. **Valhall** is 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.

In 2001, a plan for development and operation was approved for two wellhead installations that are to produce from the flanks of the field. Studies are underway to evaluate solutions for future operations in light of subsidence on the field and aging installations.

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.

Yme ceased production in 2001.

In addition to the producing fields in the southern North Sea, there is some activity in connection with discoveries. Amerada Hess is the operator for 2/12-1 Freja, where the plan is to submit a plan for development and operation in 2002. 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 have been signed for these fields. The gas is transported via pipeline, both to Zeebrugge in Belgium, through Statpipe/Norpipe and through the Europe system to Emden in Germany. The condensate is landed at Kårstø through a 250-km pipeline from Sleipner R to Kårstø. Last year, development of the Sigyn field as a satellite to Sleipner A was approved.

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.

The field is 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, as well as a template to produce what was previously known as the

Loke field. The Loke field is now considered to be a part of Sleipner Øst.

The **Gungne** field is produced from Sleipner A. Three production wells have been drilled on Gungne. One of the wells produces from the 15/9-20 S discovery, which is now considered to be part of Gungne.

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 with 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 is injected in Sleipner Øst. The gas in Sleipner Vest contains up to nine volume percent CO₂, 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 CO₂, 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 2001, the West Epsilon drilling rig was moved away from Sleipner B, leaving Sleipner B to be operated without permanent manning.

According to the original plans, a new compression installation was to be built on Sleipner Vest. These plans have now been changed so that precompression will instead be installed on Sleipner T. The next phase of the development is a subsea installation for production of gas from the northern part of the field.

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 approved in 2001. The plan is to produce until the summer of 2002. Exploration well 15/12-12 proved oil and gas in the Rev prospect south of Varg. Development is likely, but not yet resolved.

Glitne is a small oil field located in blocks 15/5 and 15/6 north of Sleipner Vest, and it has four production wells and one water injector. The development concept consists of the production and storage ship, Petrojarl 1. The field started producing at the end of August 2001 and has an expected lifetime of two-three years.

15/5-1 Dagny is a gas and condensate discovery in Jurassic rocks to the north of Sleipner Vest. A possible development concept is a subsea production system tied in to Sleipner A or Sleipner T in the event of available capacity. A potential development could also include the **15/5-2 discovery** further north. Both discoveries were made in 1978.

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. Potential development concepts are a production vessel or a jack-up installation.

16/7-4 Sigyn is situated approx. 12 km southeast of Sleipner A. The main reservoir lies in the Skagerrak formation and contains gas/condensate and light oil. The Sigyn PDO was approved in 2001. The discovery will be developed using subsea-completed wells as a satellite to Sleipner A. Esso, as operator of Sigyn, and Statoil, as operator of Sleipner A, and the licensees in Production Licence 072 want a joint implementation of the development project. The plan is to start production in December 2002.

The Balder area comprises the Balder field, including 25/8-1 Ringhorne, as well as the 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. Ringhorne started producing in May 2001, and is now included in the Balder field.

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. Produced gas is reinjected in a well on the field. The water cut from the wells has been greater than anticipated and the oil production has been significantly lower.

The plan for development and operation of **Ringhorne** was approved by the authorities in November 2000.

The subsea development of Ringhorne is complete, and was initially planned with two subsea templates tied in to the Balder ship. A well on the southeastern flank of the field proved to have substantially less reservoir sand than expected, and the development now comprises just one subsea template. The Ringhorne installation is currently under construction and will be installed on the field during the course of 2002. Oil from the Tertiary reservoirs will be transported in the pipeline to the Balder ship, while oil from the Jurassic reservoir, which is of significantly higher quality, will probably be sent via pipeline to the Jotun ship.

Jotun consists of three structures and extends between Production Licence 027 B and Production Licence 103. An agreement concerning unitization between the two production licences 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. The first phase of the drilling of production wells was completed in early 2001. A new drilling campaign is planned for 2002. The Jotun production rate was initially very good, but the water cut in the wells has gradually become high, and the field now has clearly declining oil production. The oil is loaded on the field and the gas is exported via Statpipe.

Grane contains relatively heavy oil. The plan for development and operation 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. Construction of the production installation and pre-drilling of the production wells got underway in 2001. The work schedule entails that production will commence in 2003.

1.10.2 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 is a gas field that started producing in 1977. The field is situated on both the Norwegian and British shelves. The field was developed in three stages, where Phase III commenced operations in 1981. Parts of the field are now shut down. The developments concerning water penetration will determine when the entire field will be shut down. It is expected that production from Frigg will cease in 2003. Transportation of gas from the Alwyn North field on the British side takes place via Frigg. The gas from Frigg is transported 355 km to St. Fergus in Scotland through two pipelines. The liquid is transported in Frostpipe via Oseberg to the Sture terminal.

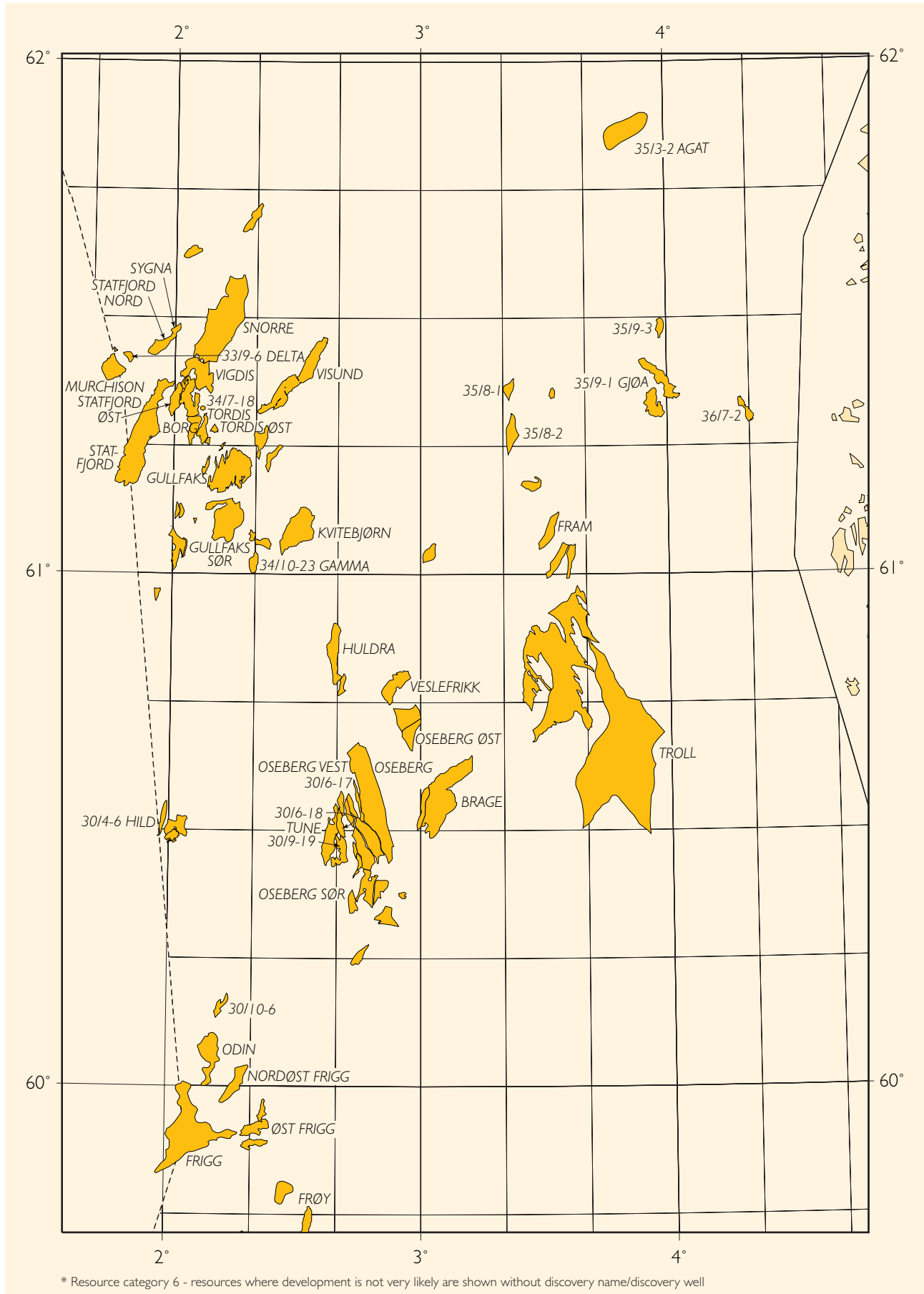
The Frøy field was shut down in March 2001 after six years of production. The oil field produced from a wellhead installation tied in to Frigg. Plugging of the Frøy wells has been completed and the installation will be removed during the course of 2002.

Heimdal started producing in 1985 from an integrated steel jacket structure with drilling, production and living quarters functions. A new riser installation commenced operation on the field in 2001. Gas from Heimdal can be transported both through the Statpipe system to Emden and, starting in 2001, also via the Vesterled pipeline to the United Kingdom. Condensate is transported via pipeline from Heimdal to Brae in the British sector, and on to Scotland. After a rebuilding phase, the field started operations again in 2001 and the remaining reserves are now being produced from the field. Gas from Huldra, which started producing in the autumn of 2001, is processed on Heimdal. Gas from Oseberg is transported via the new riser installation on Heimdal.

In the years to come, the new Heimdal Gas Center is expected to become a central hub for gas transport and phase-in of surrounding discoveries. **Vale** is a gas and condensate field currently being developed with anticipated production start-up in 2002. The field is developed with a production well drilled from a subsea installation and tied in via a pipeline to Heimdal.

Consideration is being given to phasing in other

Figure I.10.2
Fields and discoveries in the northern North Sea (Resource category 1-5) *



discoveries in the area to Heimdal. The plan is to tie in the gas discoveries 25/5-3 Skirne and 25/5-4 Byggve in Production Licence 102, as well as the oil discovery 25/5-5 Øst Heimdal, to Heimdal. A development plan could be submitted to the authorities in 2002. There are several oil and gas discoveries in Production Licence 203 that are being considered for development. Heimdal is a relevant tie-in point if decisions are made to develop these discoveries.

The Oseberg area comprises the Oseberg, Oseberg Vest, Oseberg Øst, Oseberg Sør, Brage, Veslefrikk, Huldra and Tune fields. According to the plan, Tune will start producing in 2002.

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 is a process and living quarters installation with a concrete substructure. Oseberg B is 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 2000 through a 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.

Several other minor discoveries containing oil and gas have been made on the Oseberg west flank, 30/9-19, 30/6-17, 30/6-18, 30/6-26 and 30/6-27. The two latter discoveries were made in 2001. 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.

Oseberg Sør 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 recovered 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. Some of the reservoirs will be produced using wells from two subsea templates that will be tied in to the production installation with pipelines. 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 12 km to the west of the Oseberg field center. The field was proven in 1995. The plan for development and operation was approved in December 1999. Tune will be developed with a subsea installation with transportation of the well stream to Oseberg. Pre-drilling of the production wells is underway. Production start-up is planned for the third quarter of 2002.

Brage is an oil field that also contains some gas. Production from the field started in 1993 and has been declining since 1998. 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 (OTS) to the Sture terminal. Much of the produced gas is injected to improve recovery, while the remainder of the gas is transported through Statpipe. Water injection and alternating water and gas injection are the main drive mechanisms on the field, which consists of reservoirs in the Fensfjord, Statfjord and Sognefjord formations. New wells were drilled in 2001 to increase recovery from the field.

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 12 years of production, the field is now in the decline phase, however, the field has so far produced larger amounts than was anticipated in the plan for development and operation.

Huldra is a gas discovery proven in 1982 which has been developed with an unmanned wellhead installation. Production started somewhat behind schedule in November 2001. After first stage separation, gas and condensate will be transported to Heimdal and Veslefrikk respectively.

The Troll area comprises Troll Phase I (gas production from Troll Øst), Troll Phase II (oil production from Troll Vest), TOGI and the area to the north of Troll, also called Sogn.

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 meters under the gas cap, and the Troll Vest gas province contains an oil column of 11.5-14.5 meters 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 Sm³ 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 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 licence 090 (35/11-4 Fram), production licence 153 (35/9-1 Gjød), production licence 248 (the 35/8-1 discovery and the 35/8-2 discovery), 174 and 190. The Fram oil field is undergoing development and will start producing in 2003. Fram is a subsea development linked to Troll C, with gas injection as the drive mechanism. Further exploration and development in the area are being evaluated.

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: Gullfaks, Murchison, Snorre and Statfjord, as well as several smaller gas and oil fields tied in to the main fields and using their process and/or transportation facilities: Gullfaks Sør, Tordis (including Borg and Tordis Øst), Statfjord Nord, Statfjord Øst, Sygna, Vigdis and Visund. Tampen also contains discoveries that will be developed in the next few years, in addition to potential resources in smaller, undrilled structures between the fields. The volume of remaining oil and gas in the area's reservoirs can sustain production for more than 20 years.

Gas from Tampen is transported in the Statpipe pipeline to Kårstø, while oil is loaded on ships from loading buoys at Statfjord and Gullfaks. Ten integrated living quarters, drilling and process installations are in operation on Tampen, in addition to one (Kvitebjørn) under construction. A total of 33 subsea templates are connected to the various process installations by pipelines. This represents the largest concentration of infrastructure on the Norwegian shelf.

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

The fields in the Statfjord area are in a decline phase. The challenge in the years to come will be to achieve profitable production of the remaining recoverable reserves in the fields, combined with a streamlining of the infrastructure.

The **Statfjord field** is 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 and using the Statfjord C process facility. 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 remaining gas is transported through the Statpipe pipeline to Kårstø and on to Emden, while NGL is extracted at Kårstø. The Statfjord field contains considerable gas after many years of gas injection. Consideration is currently being given to production of this gas in a late phase of the field's lifetime.

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 field is in the decline phase and tail production is maintained through water injection and a high level of drilling activity. In order to extend the field's lifetime, consideration is being given to developing some smaller discoveries in the area.

The Snorre area has the following fields in production: Snorre, Vigdis and Tordis. Tordis also includes Tordis Øst and Borg.

The southern part of the **Snorre field** is developed with a floating tension leg platform in steel (Snorre TLP) and a subsea template. The northern part of the field is developed with a semi-submersible steel production installation (Snorre B), which started production in the summer of 2001. The oil from Snorre TLP is transported to Statfjord A for final processing, while processed oil from Snorre B is transferred to Statfjord B for storage and shipping. Much 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-alternating-gas-injection) has contributed to increased oil production. In addition, a large-scale pilot project with foam injection (FAWAG) has yielded promising results. The licence has decided to increase the use of this method on Snorre.

The Vigdis and Tordis fields are developed with subsea installations. Vigdis is connected to Snorre TLP, while Tordis is connected to Gullfaks C. There are several small discoveries and prospects in the central area between Vig-

dis and Tordis which are expected to be developed during the course of the next few years. They will probably be developed using existing or new subsea templates connected to the existing installations in the area. The plan is to submit the plan for development and operation of the central area to the authorities in the summer of 2002. 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, 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 is developed with three integrated process, drilling and living quarters installations with concrete gravity base structures and steel frame topsides. 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 percent 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 56 percent based on current plans. In addition, a considerable potential for increased recovery from Gullfaks has been identified, in part by locating and draining pockets of remaining oil in water-flooded areas, and in part through increased water and gas circulation.

Gullfaks Sør consists of three discoveries; 34/10-2 Gullfaks Sør, 34/10-17 Rimfaks and 31/10-37 Gullveig, all developed with subsea templates tied in to Gullfaks A and C. In Phase I, all produced gas is reinjected in Rimfaks and Gullfaks Sør. Phase II started in the autumn of 2001 and includes export of gas from Gullfaks Sør through a new pipeline to Statpipe.

The reservoir on Gullfaks Sør has proven to be structurally very complex, leading to adjustments in the reserves estimates in recent years.

The Visund area

Visund is located to the 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. In addition, the northern part of Visund is developed using a subsea installation which will come on stream in early 2002. 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 PDO for gas export is scheduled for submission in the spring of 2002.

The Kvitebjørn area

Kvitebjørn is being developed in Block 34/11, about 20 km to the southeast of Gullfaks. The water depth is 190 meters, and the reservoir is at a depth of 4000 meters with an extent of 44 km². The field contains gas and condensate at high pressure and high temperatures. The plan for development and operation of Kvitebjørn was approved by the Storting in June 2000. Production from Kvitebjørn will start in 2004. Kvitebjørn is being developed with an integrated living quarters, drilling and process installation on a steel base resting on the seabed. 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 the refinery at Mongstad.

34/10-23 Gamma is a discovery located just 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 producing fields in the area: Njord, Draugen, Åsgard, Heidrun and Norne, see Figure 1.10.3.

These fields accounted for a quarter of the total Norwegian oil production in 2001.

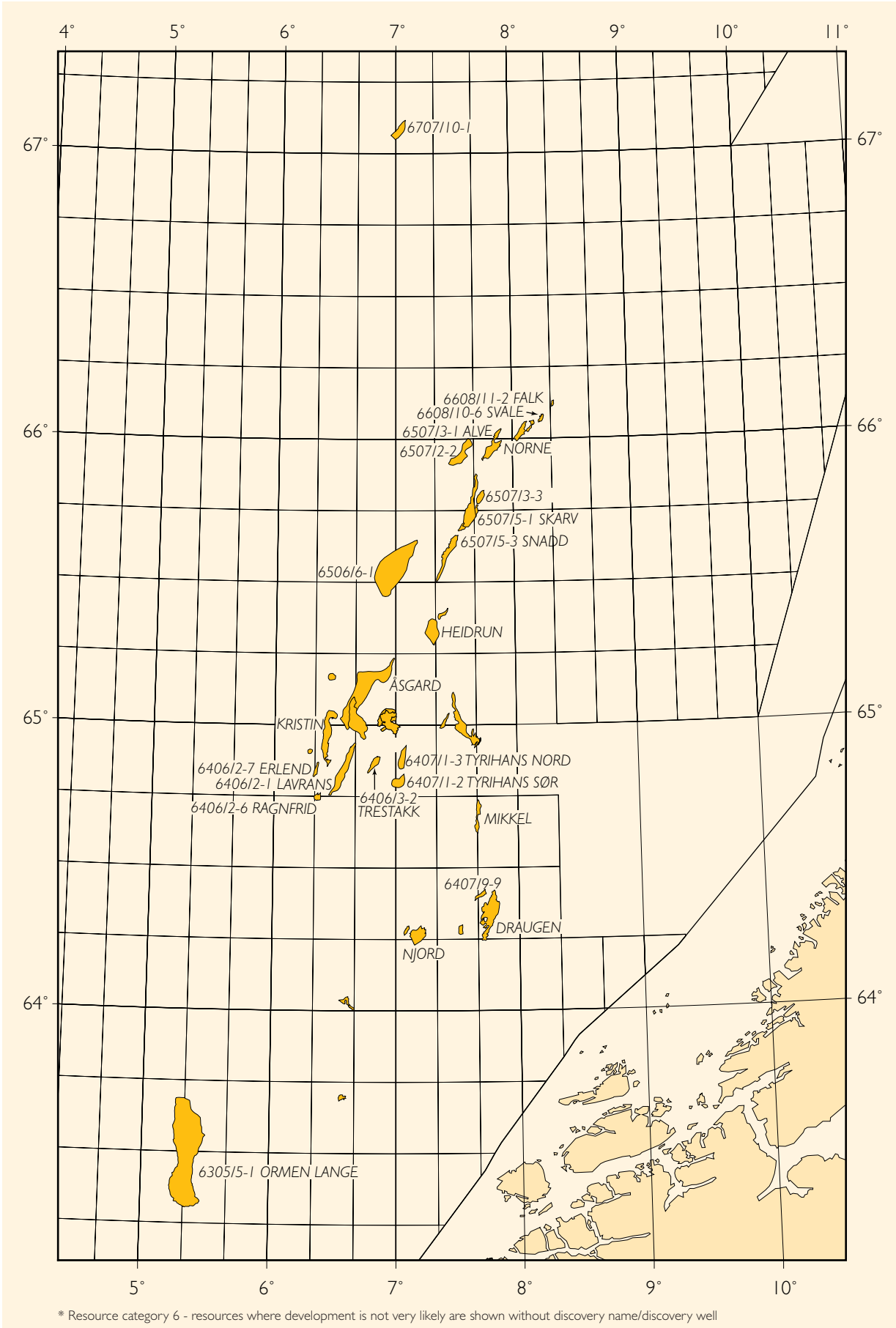
The Norwegian Sea South

Kristin is a gas/condensate field located to the southwest of Åsgard. The plan for development and operation was submitted to the authorities in August 2001 and approved in December 2001. Estimated production start-up is planned for the autumn of 2005. A semi-submersible installation with full processing has been selected as the development solution for Kristin. The gas and condensate will be transported in separate pipelines; the gas to Åsgard Transportrør for further transportation to Kårstø, and the condensate to condensate storage ships on Åsgard. The unitization agreement for Production Licences 134B, 199 and 257 was approved simultaneously with the plan for development and operation. The intention is to use Kristin as a field center in connection with the development of other discoveries and prospects in the area.

Mikkel is a gas/condensate field located in Blocks 6407/5 and 6407/6 about 35 km south of 6507/11-1 Midgard and 39 km north of Draugen. The blocks are contained in Production Licences 121 and 092.

The licensees have signed a unitization agreement, which was approved in June 2001. The plan for development and operation was submitted to the authorities in July 2001 and approved in September 2001. Mikkel will be developed using four subsea wells (three at production start-up) drilled from two subsea templates. Production from these wells will be transferred to one of 6507/11-1 Midgard's subsea templates.

Figure 1.10.3
Fields and discoveries in the Norwegian Sea (Resource category 1-5) *



From here, the wellstream will be routed together with production from 6507/11-1 Midgard to Åsgard B for processing. Planned start-up of commercial deliveries is scheduled for 1 October 2003.

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 discoveries: 6506/12-1 Smørbukk, 6506/12-3 Smørbukk Sør and 6507/11-1 Midgard, and produces via subsea-completed wells to two floating production 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.

The production on Åsgard B was shut down in August 2001 due to leaks in the gas pipeline between Åsgard A and Åsgard B, as well as in the Åsgard B gas export riser. Gas exports were lower than the design capacity also in the first six months. This is due to technical problems on Åsgard B and periods of limited capacity at Kårstø. Åsgard had to borrow gas from other fields to meet its gas export commitments. Return deliveries will take place in 2002-2003. Start-up of Åsgard B gas export after the improvements was delayed until the turn of the year 2001/2002. However, the repair work on the subsea systems is not finished and will continue in 2002.

At the end of the year, most of the planned wells on Åsgard had been drilled and completed. One of the two mobile drilling installations that has been active on the field left Åsgard in October.

Several measures have already been implemented to improve the recovery on Åsgard. The potential for increased recovery is still significant, but entails great uncertainty. Further measures are being considered.

There are several prospects and discoveries in the area that may be candidates for tie-in to Åsgard for use of available treatment and export capacity.

On the **Njord field**, where all produced gas is reinjected, the treatment and injection capacity for gas have been limiting factors for production. In addition to falling reservoir pressure, production has also been adversely affected by the fact that no new production wells were drilled in 2001, as well as by technical problems and continued replacement of flexible risers.

The reserves in the northern area have been reduced on the basis of new data and production experience. The field's potential for improved recovery has also been reduced. The condensate discovery on the Northwest flank has been evaluated with a view towards production, but was found to be not commercially profitable with conventional wells. A new drilling period starts in 2002, and three new production wells are planned. Production is expected to come off plateau in 2003. Various measures have been considered to improve the recovery, including water and WAG injection, gas injection in the northern area and advanced wells. A new gas export study started in 2001, but the timing of export start-up depends on a decision concerning possible gas injection in the northern area.

On the **Draugen field** development of additional resources is underway. Two production wells were drilled on the Garn Vest structure in 2001, and a new subsea template was installed and tied in to the production installation. Production from the Garn Vest structure started in December 2001. The additional development on the Rogn Sør structure has been approved and will be implemented in 2002. It will comprise two production wells from a subsea installation with connection to the main installation on Draugen. Production from here is expected to start in January of 2003.

The estimate for resources in place on Draugen has been adjusted upward by about five percent based on new geological information. The estimate of recoverable reserves has also increased, allowing the field's economic lifetime to be extended by seven years. It is expected that oil production will come off plateau in 2005 and that the volume of produced water will increase substantially. The treatment plant for produced water has been upgraded in 2001.

So far, more than half of the recoverable resources on Draugen have been produced. Various measures to increase recovery are being considered, including well compression, gas and WAG injection.

The Northern Norwegian Sea and deep water areas

In the area between Norne and Heidrun, several discoveries have been made, including 6507/2-2, 6506/11-2 Lange, 6506/12-3 Lysing, 6507/3-1 Alve, 6507/3-3 Idun, 6507/5-1 Skarv, 6507/5-3 Snadd and the 6506/6-1 discovery. A small discovery has also been made just to the northwest of Heidrun in well 6507/7-13. The licensees are considering development of the discoveries individually and/or in coordination using the existing infrastructure in the area; Norne FPSO, Heidrun TLP and Åsgard Transport. The gas pipelines from Norne and Heidrun to Åsgard Transport, which commenced deliveries in the first quarter of 2001, are equipped for connection of a gas pipeline from a third party.

Development of 6608/11-2 Falk has been shelved awaiting discovery of potential additional resources in the area. Prior to making a decision on development, the operator plans to drill an appraisal well downflank of the structure to determine the oil volumes.

The planned development of 6608/10-6 Svale has been delayed due to a downward adjustment of the resource estimate after drilling appraisal well 6608/10-7 in 2001. A development of the Svale discovery would only be profitable in conjunction with new discoveries in the area. The licensees are now hoping that a wildcat well on the neighboring Stær prospect in 2002 will prove sufficient additional resources so that a PDO can be submitted in 2003. The plan is to develop the discoveries using subsea-completed wells tied in to the Norne ship. Evaluations are underway concerning the upgrading of capacities on the ship and/or establishing a subsea separation facility to be connected to the ship.

Consideration is being given to developing the gas discoveries in Production Licence 122 through phase-in to the Norne ship. The licensees are awaiting a clarification on

available capacity on the Norne ship and in Åsgard Transport.

The plan is to develop 6507/5-1 Skarv in Production Licence 212 either with a dedicated field center or with a subsea development linked to Heidrun. An appraisal well will be drilled in the B segment of the discovery in 2002 to clarify the resource base before final selection of the development concept. As of now, the plan for development and operation of 6507/5-1 Skarv is scheduled for submission around the end of 2002/beginning of 2003.

The work on selecting a development concept for 6305/5-1 Ormen Lange is proceeding full force. An appraisal well planned for the spring of 2002 may confirm the resource estimate for the discovery. The final selection of a development concept is planned for the end of 2002/beginning of 2003, while the location of a potential landing site will be presented in March 2002. The landing alternative will be measured against an offshore development with a full processing facility and direct gas export south. Submission of the PDO/PIO is expected in late 2003. Development of 6305/5-1 Ormen Lange will be the first real deep water development on the Norwegian shelf.

Norne

The oil and gas on the Norne field was proven in sandstone from the Early and Middle Jurassic Ages.

Towards the end of the year, oil production from the field was at plateau with approximately 35 000 Sm³/d, with near full utilization of both oil and gas processing capacity. So far, about 40 percent of the estimated recoverable oil has been produced. The field is drained with the aid of water and gas injection. The water injection capacity was

increased in 2001 from 42 000 to 55 000 m³/d with the intention of maintaining reservoir pressure and achieving the best possible drainage.

A pilot project to evaluate microbial increased oil recovery through the injection of oxygen and nutrient salts (AMIOR) in the reservoir was successful. Full-field injection was started at the beginning of the year. Other measures for improving oil recovery that are currently being investigated include processing and interpretation of new 3D seismic with subsequent 4D interpretation for identification of undrained areas in the reservoir and future well location, as well as efficient well solutions for drainage. 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, intensive work is underway to prove and phase in new discoveries in the area.

Approximately 15 billion Sm³ gas can be produced from the gas cap on the Norne field. Gas exports from the field, which take place via pipeline to Åsgard Transport and on to Kårstø, commenced in February 2001. The gas injection volume was then cut approximately in half. The export volume is estimated at 0.9 billion Sm³/year for the first few years.

Special environmental measures implemented in 2001 included the installation of a VOC facility and testing of produced water injection.

Heidrun

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 reserves estimate has nevertheless remained unchanged.

Figure 1.10.4 Discoveries in the Barents Sea (Resource category 3-5) *

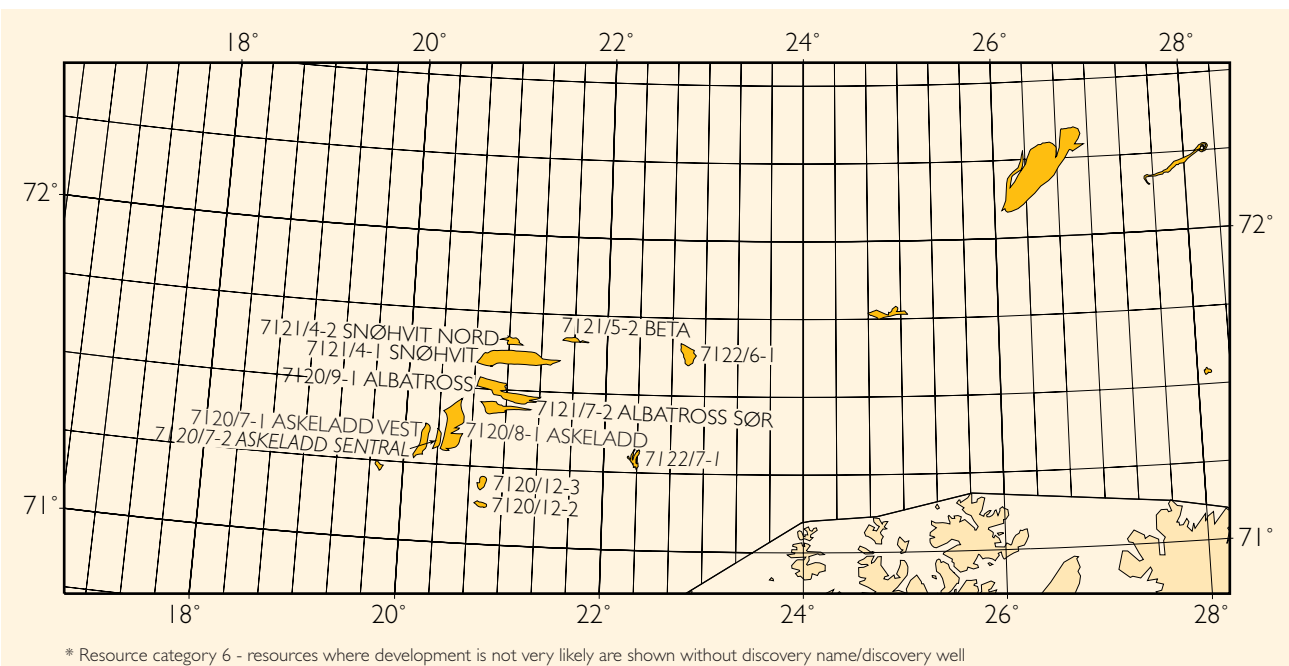
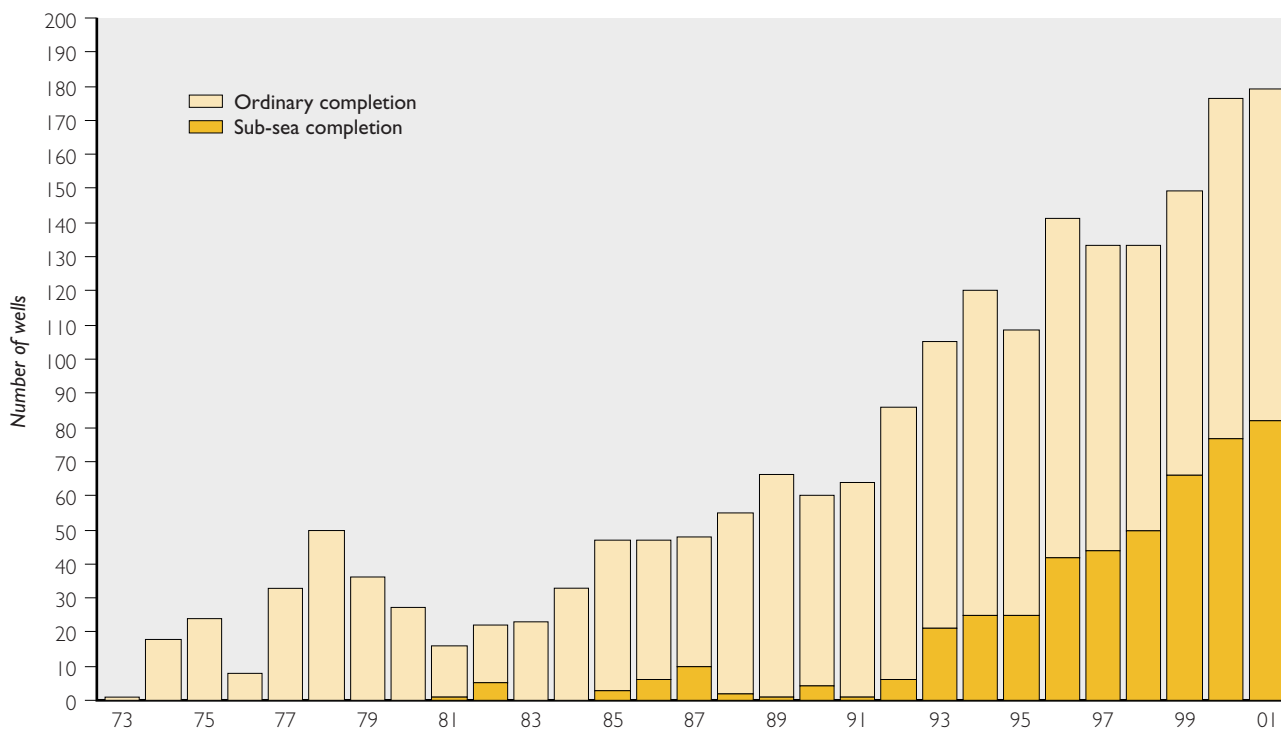


Figure 1.10.5
Development wells on the Norwegian continental shelf



The first full year of production from the northern flank of Heidrun has gone about as expected, in spite of several negative surprises in the first wells. Systematic work using several pilot holes to explore undrilled segments has yielded positive results that offset the negative surprises.

Water-handling is important on the Heidrun field. Seawater injection has proven to cause formation of salt deposits (scale) with associated reduced production and increased well maintenance. It has now been decided that a sulfate removal plant will be built for seawater. This water will then be used for injection in the deeper parts of the reservoir, so that one avoids salt precipitation (scale). The sulfate removal plant is scheduled for completion in the summer of 2003.

Gas export to Tjeldbergodden through Haltenpipe is proceeding as normal. The Heidrun field also exports gas via Åsgard Transport to Kårstø. Gas exports to Kårstø commenced in the first quarter of 2001.

The Heidrun field is well-equipped to receive production from third-party discoveries. Among other things, Heidrun TLP has available space for a new process module. Considerable exploration activity is still expected near Heidrun in the years to come.

1.10.4 THE BARENTS SEA

7122/7-1 Goliat was proven in 2000. In the autumn of 2001, Norsk Agip drilled an appraisal well on 7122/7-1 Goliat and the results from this well are evaluated as being positive with a view towards development.

Snøhvit

Snøhvit was proven in 1984 and is located about 140 km northwest of Hammerfest. The planned Snøhvit development is made of the 7121/4-1 Snøhvit, 7120/8-1 Askeladd and 7120/9-1 Albatross discoveries. Volumes from 7121/4-2 Snøhvit Nord, 7121/5-2 Beta and other small discoveries in the area are not included in the development plans. The operator's planned development concept is based on subsea installations where gas and condensate are sent in a multiphase pipeline to a facility on 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. The by-products will be liquid natural gas (LPG) and condensate, which will be shipped from Melkøya and sold on the spot market. Start-up of the gas production is planned for December 2005, while the delivery commitments to the buyers in the USA and Europe run from October 2006. Recoverable volumes amount to 193 billion Sm³ gas, and production is expected to last until 2035.

The PDO/PIO for Snøhvit LNG was submitted to the authorities in September 2001. The plans do not include recovery of the oil on Snøhvit. Oil volumes in place are estimated at 73 million Sm³. It is expected that the plans will be considered by the Storting during the first quarter of 2002. Up to the summer of 2002, the operator has pledged to continue to work on development concepts that can accommodate the requirement of a profitable and flexible exploitation of the oil resources, including a unitized development of the Snøhvit oil and the oil discovery 7122/7-1 Goliat.

1.10.5 DEVELOPMENT DRILLING

Since 1973, 2 017 development wells have been spudded on the Norwegian continental shelf; 1 836 of these in the North Sea and 181 in the Norwegian Sea where drilling started in 1992. 1 481 are production wells, 337 are injection wells and 199 are observation wells. The wells have been drilled from 161 permanent installations. Drilling was in progress on 20 development wells as of 31 December 2001. Figure 1.10.5 shows development wells spudded per year during the period 1973-2001.

As of 31 December 2001, 45 fields were producing. Twelve fields have been shut down. In 2001, 180 development wells were spudded on 29 fields. 149 of these were in the North Sea and 31 in the Norwegian Sea. 94 of the wells, i.e. 53 percent, were drilled from 20 different mobile units. The number of subsea-completed wells has shown a strong increase over the last ten years. This increase was particularly marked from 1995 to 2001 when the number of subsea-completed wells went from 25 to 84. This means that the percentage of subsea-completed wells drilled per year has increased from seven percent in 1992 to 47 percent in 2001.

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 licence or a licence 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.

The Norwegian Petroleum Directorate assists the Ministry of Petroleum and Energy in formulating guidelines for a cessation plan. The Norwegian Petroleum Directorate also contributes with assessments related to the cessation plans for the individual fields. In 2001, the consideration of the cessation plan for Ekofisk I was completed, the first draft of the Frigg cessation plan was considered and the second draft was received towards the end of the year. Evaluations concerning the timing of cessation for Varg were also made, and the cessation plan for some superfluous pipelines in the Ula/Gyda area were also considered.

Ekofisk

The cessation plan for Ekofisk I covers the older installations on the Ekofisk field that were expected to be superfluous in connection with the transition from Ekofisk I to Ekofisk II in 1998, and installations on the Albuskjell, Cod, Edda and Vest Ekofisk fields. The pumping installations 36/22-A and 37/4-A on the British shelf 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.

Factors that have played a key role in the consideration of the plan are disposal of the concrete tank and the schedule for implementing the operations. A comprehensive consul-

tation procedure was implemented under the Oslo-Paris Convention (OSPAR) in relation to abandonment of the concrete tank. OSPAR had no objections to abandoning the tank, and the matter will be submitted to the Storting in 2002.

Frigg

The Frigg field is located on the border between the Norwegian and the British continental shelves and a joint cessation plan has been submitted to the Norwegian and British authorities. Normally, there are different procedures followed when considering cessation plans in Norway and the U.K., but the operator and the authorities have reached agreement on a standard process for Frigg. This entails adjustments in relation to schedule, consultation procedures and consideration. The Norwegian model was followed up until the submission of the first draft, so that the plan was submitted two-five years prior to anticipated production shutdown. In the same manner, the entire cessation plan, and not just the impact assessment part, will be sent out for a public consultation process to follow the British system.

The plan covers a concrete installation, a steel installation and a wrecked substructure on the Norwegian shelf, as well as two concrete installations and one steel installation on the British shelf. Pipelines and cables come in addition. The first draft of the plan was considered in 2001, and the second draft was submitted towards the end of the year. This draft has now been sent out to relevant parties for public consultation.

Varg

The Varg cessation plan was considered in 2002 and as a follow-up to this, evaluations have been made concerning the shut-down time for production from this field.

Pipelines

The cessation plan for superfluous parts of pipelines linked to Ula, Gyda and 2/4-G have been considered and the impact assessment for the Frostpipe cessation plan has been evaluated.

Installations that have been removed

During the course of 2001, the installations on Yme, Tommeliten Gamma, Lille-Frigg, Øst Frigg and the topsides on the 2/4-S riser platform on Ekofisk were all removed.

Industry projects on removal and reuse

In 2000, the Ministry of Petroleum and Energy took the initiative for an industry project on removal and reuse of installations that are no longer used in the petroleum activities. Both the authorities, oil companies, relevant organizations and contractors have taken part in the study. The Norwegian Petroleum Directorate has contributed with overviews of installations on the Norwegian shelf, estimated date of production shutdown and evaluation of uncertainties linked to the shutdown date.

Figure I.11.1
Transportation systems for oil and gas from Norwegian fields



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.

Draugen Gas Export

Draugen gas export transports rich gas from the Draugen installation to Åsgard Transport. The pipeline is 78 km long and has an outer diameter of 16 inches. The capacity is approximately two billion Sm³ per year. Gas deliveries started in November 2000. Gassco is the operator starting from 2002 and Shell has been contracted to perform all activities related to technical operation.

Franpipe

Franpipe is an 840-kilometer pipeline with an outer diameter of 42" running between Draupner E (16/11 E) and Dunkerque in France. The pipeline has a capacity of 16 billion Sm³ 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. Gassco is the operator starting from 2002 and Statoil has been contracted to perform all activities related to technical operation.

Frigg transport

Ownership of the Norwegian Frigg pipeline (FNP) has been transferred to Vesterled.

Haltenpipe

Haltenpipe is a 250-kilometer 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 Sm³ per year. The pipeline was put into operation in 1997. Gassco is the operator starting from 2002 and Statoil has been contracted to perform all activities related to technical operation.

Heidrun Gas Export

Heidrun gas export transports rich gas from the Heidrun installation to Åsgard Transport. The pipeline is 39 km long with an outer diameter of 16 inches. The capacity is approximately four billion Sm³ per year. Gas deliveries started in November 2000. Gassco is the operator starting from 2002 and Statoil has been contracted to perform all activities related to technical operation.

Europipe I

The pipeline runs from Draupner E (16/11 E) to Emden in Germany and is approx. 620 kilometers long and has an outer diameter of 40 inches. The capacity is approximately 13 billion Sm³ gas per year. Gas deliveries started on 1 October 1995. Gassco is the operator starting from 2002 and Statoil has been contracted to perform all activities related to technical operation.

Europipe II

Europipe II is a 658-kilometer pipeline with an outer diameter of 42" for transportation of gas from Kårstø to Dornum. The pipeline has a capacity of 21.7 billion Sm³ per year and was put into operation on 1 October 1999. Gassco is the operator starting from 2002 and Statoil has been contracted to perform all activities related to technical operation.

Norne Gas Export

Norne Gas Export transports rich gas from the Norne installation to Åsgard Transport. The pipeline is 128 km long and has an outer diameter of 16 inches. The capacity is approximately 3.6 billion Sm³ per year. Gas deliveries started in November 2000. Gassco is the operator starting from 2002 and Statoil has been contracted to perform all activities related to technical operation.

Norpipe gas pipeline

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

The gas pipeline is 442 kilometers long and has an outer diameter of 36 inches. The design capacity is about 14 billion Sm³ per year, assuming use of the B11 compressor station 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. The Norpipe system is connected to Europipe so that gas from Norpipe can be delivered via the Europipe system and vice versa. Phillips Petroleum Norsk AS is operator on behalf of the Phillips Group.

Oseberg Gas Transport

Oseberg Gas Transport is a 108-kilometer 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 Sm³ per year and was put into operation on 1 October 2000. Gassco is the operator starting from 1 January 2002 and Norsk Hydro has been contracted to perform all activities related to technical operation.

Statpipe Transport

The Statpipe system is an 880-kilometer long pipeline network comprising:

- rich gas pipeline from the Statfjord area and the Gullfaks, Snorre, Brage, Tordis and Veslefrikk fields to Kårstø. The transportation capacity for the pipeline from Statfjord to Kårstø is 8.5-9 billion Sm³ per year. The pipeline has an outer diameter of 30 inches.
- separation and fractionating plant at Kårstø, plus storage and loading facility.
- a dry gas pipeline from Heimdal to the Draupner S riser platform with a length of 155 km and an outer diameter of 36", a dry gas pipeline from Kårstø to Draupner S with a length of 228 km and an outer diameter of 28", and a pipeline from Draupner S to the Ekofisk bypass with a length of 188 km and an outer diameter of 36".

Gassco is the operator starting from 2002 and Statoil has been contracted to perform all activities related to technical operation.

Zeepipe

Zeepipe is a gas transportation system which transports gas from Kollsnes in Øygarden to the Continent. Phase I of the project comprises an 800-kilometer pipeline with an outer diameter of 40" from Sleipner to Zeebrugge in Belgium. In addition, an approx. 40-km pipeline has been installed from Sleipner to Draupner S (16/11-S). Phase I, including the Zeebrugge terminal, was completed in 1993. The capacity without compression is approx. 12.6 billion Sm³ 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 Sm³ per year respectively. Gassco is the operator starting from 2002 and Statoil has been contracted to perform all activities related to technical operation.

Vesterled

Vesterled is the name of a new 45-km pipeline with a diameter of 32" that is connected to the Norwegian Frigg pipeline, enabling transportation of gas from Heimdal to St. Fergus in the United Kingdom. The capacity is 12-13 billion Sm³ per year. The entire Vesterled pipeline system consists of the existing former FNP pipeline, the Norwegian part of the terminal at St. Fergus and 50 percent of the joint facilities at the terminal, in addition to the new connection. Gas transportation started in October 2001. Gassco is the operator starting from 2002 and Total Oil Marine has been contracted to perform all activities related to technical operation.

Åsgard Transport

Åsgard Transport is a 745-kilometer 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 approx. 20 billion Sm³ per year and commenced operations on 1 October 2000. Gassco is the operator start-

ing from 2002 and Statoil has been contracted to perform all activities related to technical operation.

Oil transportation**Frostpipe**

Frostpipe is an approx. 80-kilometer pipeline with an outer diameter of 16" for transportation of stabilized oil and condensate between Frigg and Oseberg. The transportation system has a capacity of about 16,000 Sm³ per day. Operations started in the spring of 1994. TotalFinaElf 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 Norse Pipeline Ltd. companies. Phillips Petroleum Company UK Ltd. is the operator of the facilities.

Oseberg Transport System (OTS)

The 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 a design capacity of approximately 95,000 Sm³ per day. By adding drag reducers, the capacity has been increased to about 117,000 Sm³ per day.

The plant, including the Sture terminal, 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, Gungne, and also Sigyn when this field starts production, to Kårstø. The pipeline is approximately 250 km long and has an outer diameter of 20". The capacity is up to 29,000 Sm³ 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 transport

Ula transport consists of the Ula pipeline and the Gyda pipeline. The pipelines transport oil and NGL from Ula, Tambar 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 kilometers long with a diameter of 20" and has been in operation since 1986. The pipeline from Gyda to the Ula pipeline is 25 kilometers 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 platform to the Grane installation. The pipeline is 50 kilometers long and has a diameter of 18 inches. Planned start-up is in 2003. The capacity will be approximately 3.5 billion Sm³ per year. 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 kilometers long and has a diameter of 29", which will give a transport capacity for the Grane oil of 40,000 Sm³ 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. The 140-km long gas pipeline was originally approved as a 26-inch pipeline. It has subsequently been converted to 30 inches to allow transportation of larger volumes of wet gas. The additional volumes can come from the Tampen or Troll areas. The gas was originally to be treated in a dewpoint plant in the Troll facility. The current plan is to build an NGL plant instead. This will make it possible to extract propane, butane and naphtha from the gas and send these components in the existing condensate pipeline to Mongstad for further refining. Statoil is the operator of the pipeline. The pipeline will have a capacity of more than 9 billion Sm³/year. The capacity depends on where the gas is received in the pipeline. The pipeline will be put into operation in 2004.

Kvitebjørn transport

The Kvitebjørn oil pipeline (KOR) 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 T connection, which is already installed on TOR II. The diameter of KOR ended up as 16" as proposed in the PIO, after a lengthy period in which it was proposed that the diameter should be 20" so as to accept oil from Gullfaks in the same pipeline. Start-up of oil transportation is planned for the year 2004.

2.1 INTRODUCTION

The Norwegian Petroleum Directorate's performance of its administrative duties is based on a comprehensive administration of the petroleum activities in the areas of health, safety and the working environment. The Norwegian Petroleum Directorate has 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 areas where it has no expertise of its own.

Administration of health, safety and the working environment is carried out 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 regulatory framework that applies to the petroleum activities.

Therefore, supervision of regulatory compliance is primarily aimed at management systems and decision processes that have significance for health, 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 health, safety and the 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 parties that participate in the petroleum activities. The Directorate also provides advice to the supervising ministries with regard to the overarching framework for the activities, as well as in special cases.

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 System Regulations, Royal Decree of 27 June 1997

The Safety Regulations and the Management System Regulations were repealed as of 1 January 2002. The Framework Regulations, Royal Decree of 31 August 2001, entered into force on 1 January 2002.

- 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
The Working Environment Regulations are repealed with effect from 1 January 2002. The Framework Regulations, Royal Decree of 31 August 2001, entered into force on 1 January 2002.
- 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 PRIORITY AREAS IN 2001

Prioritizations that affect administration of health, safety and the working environment are primarily prepared by the Ministry of Labour and Government Administration. In 2001, the Ministry asked the Norwegian Petroleum Directorate to prioritize efforts in the following areas:

- 1 Completion of new regulations for health, environment and safety
- 2 Supervision of mobile installations
- 3 Supervision of the organizational change processes
- 4 Supervision of the companies' maintenance of technical condition
- 5 Methodology for describing and following up the safety level

Efforts in and results from the work within these priority areas are discussed under *Section 2.4 Terms for the activities* (Priority 1) and *Section 2.5 Supervision of the activities* (Priorities 1-4).

2.4 TERMS FOR THE ACTIVITIES

2.4.1 NEW REGULATIONS FOR HEALTH, ENVIRONMENT AND SAFETY IN THE PETROLEUM ACTIVITIES

In 2001, the Norwegian Petroleum Directorate, together with the Norwegian Pollution Control Authority and the Norwegian Board of Health, 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 and the Royal Decree of 28 June 1985 regarding the supervision system. The work has been carried out in a close dialogue with the tripartite regulatory

forum “External Reference Group for Regulatory Development” (ERR).

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 has also been 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 better adapt the regulations to the structure of the EEA regulations.

The affected ministries have participated actively in this work and have had particular responsibility for the overarching regulations (the “Framework Regulations”).

The new HES regulations were issued in the autumn of 2001, the Framework Regulations by Royal Decree of 31 August and the four supplementary regulations (the Management Regulations, the Information Duty Regulations, the Facilities Regulations and the Activities Regulations) on 3 September. All of the regulations entered into force on 1 January 2002. The regulations have been well-received by the industry and the trade unions.

The new regulations on health, safety and the environment in the petroleum activities do not contain technical guidelines prepared by the Norwegian Petroleum Directorate. The regulations do, however, refer to a significant number of national and international standards, including more than 40 NORSOK standards.

Considerable effort has been devoted to the language in the new regulations and the response indicates that the formulations are good, clear and easy to understand.

The new regulations have been published on the Norwegian Petroleum Directorate’s web pages. The former printed editions of the regulatory compilation will no longer be published.

External expertise enhancement measures have been implemented through “Regulatory Expertise for the Petroleum Industry” (RVK) under the direction of the Norwegian Oil Industry Association (OLF), the Norwegian Shipowners’ Association, NOPEF, OFS, Lederne and BI. The Norwegian Petroleum Directorate has contributed actively as a supplier of materials, expertise and lecturers.

2.5 SUPERVISION OF THE ACTIVITIES

2.5.1 SCOPE OF THE SUPERVISION

The Norwegian Petroleum Directorate expends a significant amount of its personnel resources on the supervision of how the companies that participate in the petroleum activities on the Norwegian shelf safeguard their obligations in accordance with 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 regulatory requirements
- individual decisions and other use of policy instruments
- meetings with affected parties in connection with supervision
- management and administration of the supervision activities

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 players in the activities. A number of factors affect the contents of the annual plan, such as:

- Prioritizations from superior ministries
- Overall 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

In 2001, the reimbursable part of the Directorate’s supervision work amounted to 53 311 man-hours, compared with 56 835 hours in 2000. The reduction is linked to the extensive reorganization implemented by the Directorate on 1 January 2001. It is expected that the new organization will contribute to more efficient management, and thus make it possible to dedicate more resources to the supervision in the future, while also increasing its effect. To achieve this, however, it has been necessary in 2001 to allocate resources to certain internal activities so as to create the best possible foundation for reaching the goals set for the Norwegian Petroleum Directorate’s management of health, environment and safety in the petroleum activities.

2.5.2 EXPERIENCES FROM THE SUPERVISION ACTIVITY

Mobile installations

This prioritization has largely been handled through the Norwegian Petroleum Directorate’s continuous follow-up,

partly in the form of processing the operating companies' applications for consent for activities entailing the use of a mobile installation, and partly in the form of supervision to ensure that preconditions stipulated in consents are observed.

The supervision has among other things been directed at factors related to clarity and a common understanding of the division of responsibility and tasks among operating companies, contractor/owner and verifier, and also that each participant is responsible for its respective responsibility in practice. In this context, the Norwegian Petroleum Directorate has also been concerned with how the players work together to achieve improvements in the technical condition of the installations. Supervision has also been aimed at the quality and effect of the evaluation processes implemented by the operators in connection with hiring mobile installations for their 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 is often linked with a failure in the procedures for mapping and handling deviations. Deficiencies revealed by operating companies that have entered into a contract for use of an installation has also affected the Directorate's choice 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) for mobile installations, which took effect in 2000. The experiences with this work are discussed in Chapter 2.6.2.

Conclusions drawn from the supervision and other feedback seem to indicate that the supervision has helped to ensure that mobile installations used on the Norwegian shelf have been in proper condition as regards safety, and have been operated in a prudent manner.

Furthermore, it is the Directorate's opinion that improvements have been achieved with regard to cooperation and interaction among the operators, owners of installations and union representatives. Employee participation in connection with the hiring of mobile installations also seems to function better.

Other conclusions drawn from supervision of mobile installations can be summarized in that the industry seems to have achieved improvements and gains in areas such as the following:

- overview of technical condition of the installations
- general safety standard on the installations
- control/management systems
- better and more realistic overview of deviations and regulatory exceptions on the installations
- improved understanding of the regulations in the industry
- more efficient and coordinated supervision by the authorities

- predictability and efficiency gains already experienced for installations with SUT
- improved basis for consideration and use of SUT and Safety Case, both nationally and internationally

Organizational change processes

Prioritized tasks in this area have largely consisted of follow-up of experiences from previous years. The Norwegian Petroleum Directorate's annual report for 1999 provides a comprehensive summary of problem areas and experiences linked to the organizational change processes that were implemented in the industry, and which are still underway.

The supervision has been aimed at how the new organizations handle the challenges related to health, safety and working environment. The supervision activities in this area in 2001 have primarily been aimed at the companies' capacity and competence to carry out necessary maintenance and other activities that contribute to maintain a proper technical standard for facilities and equipment. 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.

In the supervision of the operative activities in 2001, primary focus has been aimed at contractors, particularly within the fields of maintenance and catering. Supervision has been carried out in respect of implementation of internal company principles, methods and tools for managing installations, with focus on how the contractors, in coordination with the operators and the employee organizations, develop a practice for planning, implementing and following up the change processes.

In connection with the work on developing methodology to describe and follow up the safety level, the Norwegian Petroleum Directorate has gathered input data via surveys and in-depth interviews. Some of the topics raised relate to change and development processes. The results of this work will be useful contributions as regards prioritization. The work of gathering a primary volume of data has begun.

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 major accidents. The supervision activities in this area have primarily focused on:

- Fulfillment of requirements for lifting operations, inspection, maintenance and modifications of cranes and lifting gear, as well as working environment related to lifting operations.
- Systems for investigation, analysis, follow-up, implementation and verification of measures, and evaluation of these in relation to regulatory requirements,
- Management systems and measures to reduce the risk of major accidents, including measures to prevent hydrocarbon leaks, and to maintain delivery security/regularity.
- How the companies ensure that measures adopted after

incidents are carried out and how they verify that measures have been implemented and function.

- Emergency preparedness on the installations, including emergency response plans, emergency drills/training and evacuation and rescue equipment.

In connection with the work to develop a methodology for describing and following up the safety level, the Norwegian Petroleum Directorate has collected data on the technical condition of the installations on a basic level, particularly with a view towards showing an overview of the potential danger of major accidents. This database will be a useful contribution to future supervision activities in this area.

Health, environment and safety level

After a long period of positive trends in health, safety and environment in the petroleum activities, the Norwegian Petroleum Directorate has in recent years registered a number of signals that indicate that the risk level is in the process of developing a negative trend, in other words, the former 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.

In order to create a reliable basis from which to draw unambiguous conclusions concerning the risk level on the shelf, the Norwegian Petroleum Directorate implemented a project in 2000 to establish a basis for measuring performance in relation to the safety level in the petroleum activities on the Norwegian shelf.

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. The report from the preliminary project was available in April 2001, and concluded by confirming that the risk level has increased in recent years.

After the model has been tested during the course of the year, the Directorate has decided to put the model to use as a permanent tool to maintain an overview of the level of health, safety and environment and how this develops over time, with a view towards implementing measures at the right place and time.

Specifically, the Directorate's work in this area in 2001 has been aimed at clarifying the causes of personal injuries, work-related disease and other undesirable incidents, as well as evaluating and implementing follow-up measures in relation to the above. The efforts have been aimed both at technical and organizational measures, and also includes supervision of the players' own audit activities.

Fatal accidents, serious personal injuries and other serious incidents shall be reported to the Norwegian Petroleum Directorate immediately so that the Directorate can determine whether or not there is a need for immediate measures in each individual case. 442 such incidents were reported in 2001, compared with 523 the previous year. There has also been a reduction in other injuries and incidents reported to the Directorate, such as less serious personal injuries, work-related disease, gas leaks and structural damage to installations. This data will be reviewed in detail in 2002. It is too early to say whether this data indicates a positive trend. In addition to the measurable factors mentioned here, the overall risk scenario includes factors such as aging installations, new technological challenges and how health, safety and the environment are managed in the activities.

2.6 ADVISORY ACTIVITY

2.6.1 STORTING WHITE PAPER ON HEALTH, ENVIRONMENT AND SAFETY

On 14 December 2001, the Ministry of Labour and Government Administration presented Storting White Paper No. 7 (2001-2002) on health, environment and safety in the petroleum activities. The Norwegian Petroleum Directorate has been a significant contributor to the Ministry's work on the white paper. The Directorate's work has been based on a thorough process involving employees, employers and external technical milieus.

Among other things, the Norwegian Petroleum Directorate organized two seminars in April 2001 with broad-based participation from the parties in working life and the relevant authorities. The purpose of the seminars was to highlight all elements of significance for the White Paper and to ensure the most unified perception possible of the status of health, environment and safety in the petroleum activities on the Norwegian shelf.

This process provided a valuable contribution towards creating a solid basis for the input and recommendations submitted to the Ministry as a result of this work. The process has also strengthened the Directorate's basis for prioritizing future work within the framework stipulated by the Ministry.

The White Paper is action-oriented and concludes with proposals for concrete measures in a number of areas. Among other things, the Ministry proposes a strengthening of the Norwegian Petroleum Directorate and the Directorate's supervision. This has already resulted in an increase of NOK 7 million in the Norwegian Petroleum Directorate's operating budget for 2002, which is earmarked for measures to enhance competence.

It is expected that the Storting White Paper will be considered by the Storting in the 2002 spring session.

2.6.2 ACKNOWLEDGEMENT OF COMPLIANCE SYSTEM - SUT

Three acknowledgements under the new system were given in 2001. Thus, a total of four acknowledgements have been given after the SUT system took effect on 1 August 2000. During 2001, the Norwegian Petroleum Directorate presented acknowledgements of compliance to the following mobile drilling rigs:

- West Vanguard (Smedvig)
- Deepsea Bergen (Odfjell)
- West Alpha (Smedvig)

The system itself was discussed in detail in the 2000 annual report. The acknowledgement of compliance (SUT) is an optional system, i.e. a service offered by the Norwegian Petroleum Directorate to shipowners/owners of mobile rigs. The intention of the system is to contribute to providing the owners of mobile rigs with improved predictability concerning the rig's suitability in relation to the requirements of the petroleum regulations. 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 naturally belongs.

The shipowners' preparation of applications has gone slower than the original plan prepared by the Norwegian Shipowners' Association. This is due, among other things, to the fact that a number of needs for upgrades, correction of deviations, etc. have emerged in connection with preparation of the applications. The shipowners have thus incurred costs, but the Directorate still assumes that the system could lead to savings for the industry because verification work, etc. will no longer have to be repeated at 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.

2.7 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 transferred to the Directorate's database 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.

There were no fatal accidents within the Norwegian Petroleum Directorate's area of responsibility in the petroleum activities in 2001.

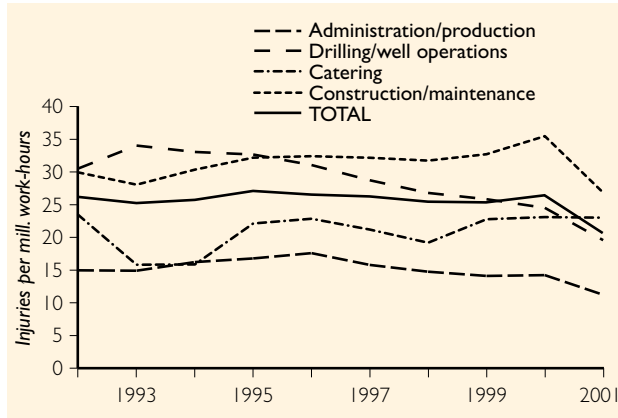
Tragically, however, one man did die of injuries he suffered in an industrial accident on an anchor-handling vessel on 31 May 2001 when he was struck in the head by a shackle during deployment of anchors. This accident is being followed up by the maritime authorities in cooperation with the Norwegian Petroleum Directorate. The accident is not included in the statistics for injuries in the petroleum activities.

In the autumn of 2001, the personal injury database showed a significant decline in the number of reported personal injuries. In order to ensure the quality of the database, a comprehensive inspection was conducted of reports for 2000 and 2001. This inspection showed in part significant discrepancies between the operators' and the Norwegian Petroleum Directorate's data. Many unreported injuries were revealed, in spite of the fact that they should have been reported. The review also showed that the Norwegian Petroleum Directorate had received reports of many injuries on RTV forms that were not included in the operators' summaries. During the inspection, errors were also uncovered in the Norwegian Petroleum Directorate's statistics for 2000. These errors have been corrected and the 2000 figures have been adjusted in this year's overviews.

In 2001, the Norwegian Petroleum Directorate received reports of 679 personal injuries that occurred on installations in the petroleum activities on the Norwegian shelf. In addition, there were reports of 40 injuries classified as off-duty injuries and 154 classified as first aid injuries. Adjusted figures from 2000 show that 843 reportable personal injuries occurred this year, in addition to 35 reported off-duty injuries and 106 first aid injuries. The number of first aid injuries has thus increased significantly from 2000 to 2001, while the total number of injuries has shown a marked decrease. First aid injuries and off-duty injuries are not included in the figures and tables shown here.

The discrepancies uncovered through the inspection of the operators' and the Norwegian Petroleum Directorate's data show that there is some uncertainty linked to the figures. The operators have informed the Norwegian Petroleum Directorate that they will review the reporting procedures in light of the experience gained, and the

Figur 2.7.1
Personal injury frequency on permanently placed installations for main activities in relation to work-hours



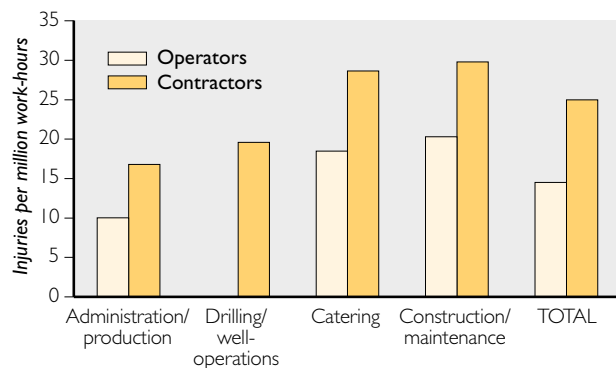
Directorate will follow up the reporting procedures through supervision activities in 2002.

Figure 2.7.1 shows the injury frequency per million man-hours for the last ten years for injuries on permanent installations. The figure also illustrates the injury frequencies for the various main activities on the installations. While the injury frequency in the years 1992 to 2000 showed small variations from 25.3 to 27.2 injuries per million man-hours, the injury frequency in 2001 shows a clear decline to 20.8. Since 1996, construction and maintenance activities have provided the largest contribution to the overall injury frequency on the shelf, although the injury frequency for this group was reduced from 35.4 in 2000 to 26.8 in 2001. There has also been a steady decline in the area of drilling and well operations, from 34.0 in 1993 to 24.5 in 2000. The figures for 2001 show a marked decline to 19.5 injuries per million man-hours.

Figure 2.7.2 shows that contractor employees on permanent installations are more vulnerable to injuries than operating company personnel.

Figure 2.7.3 shows the frequency of injuries within the main activities on mobile installations for the past ten years. As for the permanent installations, the overall injury frequency here shows minor changes in the period 1992-2000, but a clear decline from 33.7 in 2000 to 22.4 in 2001. Within

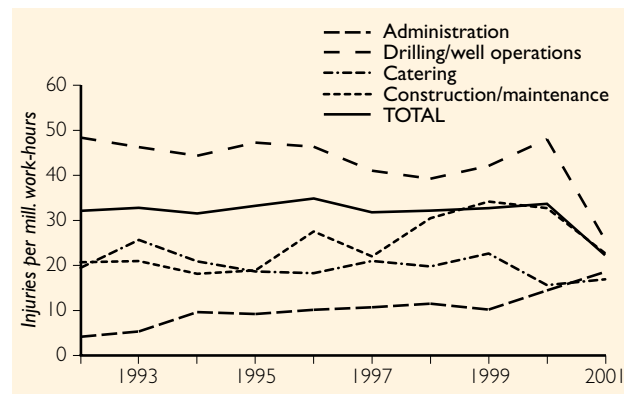
Figure 2.7.2
Personal injury rate by operators and contractors on permanently placed installations - 2001



the area of drilling/well operations, there was an increase in injury frequency from 1999 to 2000, while the figures show a clear decline from 48.0 in 2000 to 25.6 in 2001. The injury frequency within operations and maintenance varied in the 1990s and was highest in 1999 with 34.1 injuries per million man-hours. The figures for 2000 show that the injury frequency was reduced to 32.7. This trend has continued and the injury frequency for 2001 is 22.7. Within the area of administration, the injury frequency has varied from 4.1 in 1992 to 11.5 in 1998. This rose to 14.4 in 2000. The increase has continued and the injury frequency for 2001 ended up at 18.5.

In connection with the project "Trends in risk level on the Norwegian shelf", work is being done to identify serious personal injuries. The result will be presented, together with other risk indicators, in a report from the project expected in April 2002.

Figure 2.7.3
Personal injury frequency on mobile installations for main activities in relation to work-hours

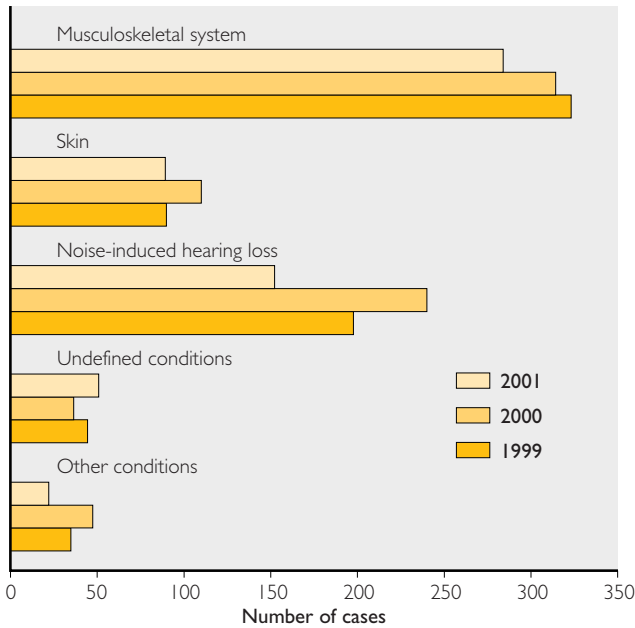


2.8 WORK-RELATED DISEASES

The incidence of work-related diseases is an important indicator of 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 598 cases of work-related diseases in 2001. Of these, 107 were operator employees and 491 were contractor employees. This represents a 19.5 per cent decrease in the number of notifications as compared with 2000, giving a notification frequency of 18.9 incidents per million man-hours. After a sharp increase in the number of reported incidents during the period 1992-1996, the number of cases in recent years has been fairly constant. The frequency decreased a bit compared with the previous year, however, fluctuations of this magnitude must be expected without granting them too much weight. A large part of these fluctuations are due to variations in the number of reported incidents of noise-induced hearing loss.

Figure 2.8.1
Distribution of work-related diseases on diagnosis groups 1999-2001



In order to help ensure that the companies continue to focus on work-related diseases and use collected data in preventive work, the Norwegian Petroleum Directorate carried out audits of reporting and further follow-up of new cases both on the part of operating companies and contractors in 2000 and 2001. The purpose of this work was, among other things, to achieve a more uniform reporting practice on the part of the companies. The audit activity was primarily aimed at the operators' supervision of their own and subcontractors' systems in this area. The Directorate summarized the conclusions of the audit in a letter to the affected companies in December 2001. A press release was also prepared and sent out in January 2002.

If we disregard hearing injuries due to noise (146 cases), the frequency of other diseases is 14.3 cases per million man-hours. This is considerably higher than what has been reported for land-based industry. There is reason to believe that there is still a certain under-reporting, as there continue to be few reports from some companies with many employees on the shelf. This impression was reinforced by the above-mentioned audit activity.

Starting from 1999, the reporting format for work-related diseases in the annual report was altered so as to better highlight the main features of the material, and to achieve a clearer correspondence between injuries and work activity. Figure 2.8.1 shows the distribution of some of the main groups of work-related diseases registered in the period 1999-2001. 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. There was a substantial reduction in the number of reported incidents of noise-induced hearing loss, from 240 in 2000 to 146 last year. Large fluctuations in the reporting frequency of noise-induced hearing loss in recent years and a periodic accumulation of reports indicates a lack of good procedures in some companies in this area.

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 a small increase in the number of such incidents compared with the previous year, from 43 per cent of reported incidents in 2000 to 48 per cent in 2001. The dominant proportion of muscular-skeletal ailments underlines the recognized fact that it is important to work on preventive measures in relation to these conditions. 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 2.8.2. 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 2001, and this proportion increased from 33 per cent in 2000 to 44 per cent in 2001. With increased mechanization, it is not likely that this is due to more heavy manual labor in general, but the figure does highlight the importance of organizing the work well. Another important cause of this type of ailments was repetitive monotonous work. Both heavy work and repetitive monotonous work are listed as

Figure 2.8.2
Exposure factors - musculoskeletal conditions

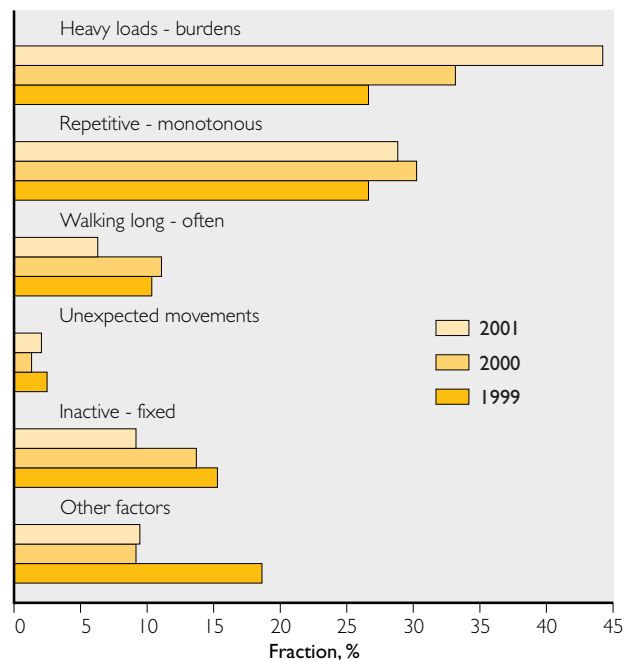
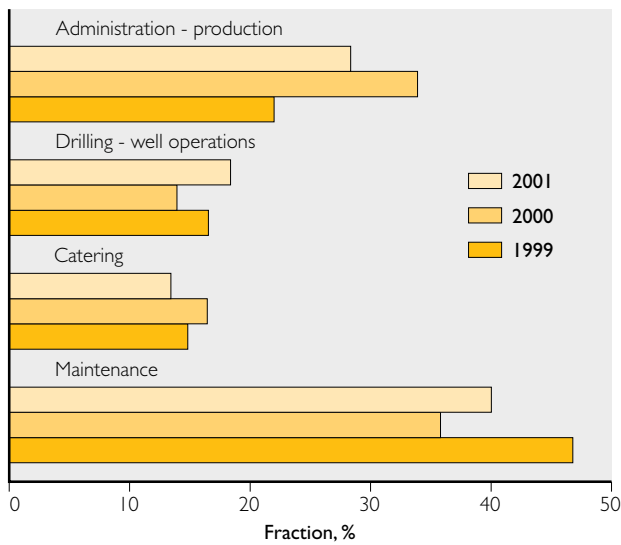


Figure 2.8.3
Distribution of work related diseases on work categories



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 has been cut nearly in half compared with the previous year, from 11.0 per cent to 6.3 per cent. Heavy lifts, in addition to sudden movements and non-active/sedentary work can result in back ailments in the form of lumbago/sciatica. The percentage of the two above-mentioned working environment factors as the cause of back ailments has declined somewhat compared with the previous year, from 14.8 to 11.2 per cent. 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 factors" and, among other things, constitutes an important reason for the high number of such cases observed in 1999. The percentage of incidents attributed to crawling/kneeling work in 2001 was the same as in the previous year.

Skin ailments constitute another large diagnosis group. The number of incidents in this group declined a bit, while the percentage was unchanged compared with the previous year. More than half (59 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 four cases of contact eczema (down from 13 cases the year before) and one case of general allergic reaction. This is a gratifying reduction in the number of cases. Due to the serious nature of this type of ailments, preventive work in this area is extremely important. In 2001, as in 2000, there were no reports 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 35 cases of sleep disturbances in this group, as compared with 19 cases in 2000. In spite of last year's increase, the number of these types of cases has declined in recent years. This reduction may be due to the fact that several companies have discontinued the swing shift system. However, there is a high rate of consumption of sleeping medicines on the offshore installations, which could indicate that there is a significant under-reporting of sleep difficulties.

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. One case of asbestos-related lung disease has also been reported, as well as two cases of malignant tumors due to chemical exposure. In these types of cases, the harmful exposure often occurred several years earlier. Last year, no illnesses were reported listing isocyanates as the cause. The fact that a total of three 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.

The various position categories that were exposed to work-related diseases are shown in Figure 2.8.3. Workers within the drilling sector have normally been perceived as being particularly vulnerable. However, taking into account that this function performed 26.9 per cent of the total man-hours, the percentage of cases is considerably lower than would be expected. This percentage increased compared with the previous year, from 14 per cent in 2000 to 18.3 per cent in 2001. 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 2001 when the percentage was 13.4, while the percentage of man-hours for this group was 9.6 per cent. In 2001, the number of reported incidents in the construction and maintenance group was somewhat higher than the previous year. This group was responsible for 39.1 per cent of the total man-hours, but accounted for 40.0 per cent of the reported incidents of disease. The percentage of cases is thus as expected in relation to the total number of hours' exposure. The percentage of cases in administration and production fell from 33.8 per cent in 2000 to 28.3 per cent in 2001. Administration and production are thus disproportionately represented compared with the work volume of 24.4% of the total man-hours worked. Fluctuations in the number of cases compared with the work volume for this group in recent years is largely based on the variation in the reports of incidents of noise-related hearing loss.

2.9 HYDROCARBON LEAKS, FIRES AND NEAR-FIRES

2.9.1 HYDROCARBON LEAKS

Figure 2.9.1 shows the number of reported hydrocarbon leaks with volumes estimated at more than 0.1 kg/s for the past five years. These leaks form part of the basis for calculating the risk level on the shelf. None of the leaks that occurred during the past year are characterized as “large” based on an assessment of seriousness. The size of the leak is incorporated with other factors in the assessment of the seriousness.

In 2001, a total of 106 incidents of hydrocarbon leaks were reported, which also includes minor, unintentional emissions of hydrocarbon gas.

Figure 2.9.1
Hydrocarbon leaks distributed according to size category 1996-2001

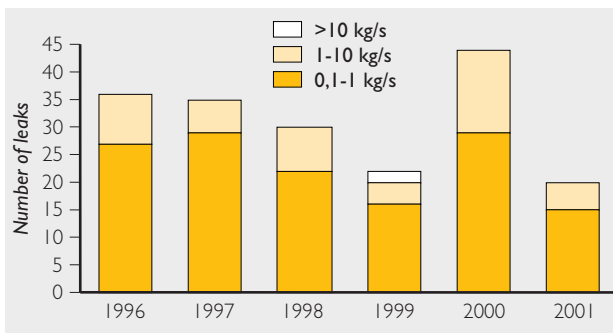


Figure 2.9.2 illustrates the areas of the installations on which the hydrocarbon leaks occurred. Most leaks occur in the gas treatment area. This is linked to the fact that more gas is produced overall and thus more equipment is installed for treating the gas on the installations.

Information from the reports on the leaks shows that more than half are discovered by automatic detection equipment, while the remainder are discovered by personnel in the relevant area. This applies mostly to small leaks from valves and connections where the volume is too small to be registered by the gas detectors.

Figure 2.9.3 shows that the main types of faults that lead to leaks are, as in previous years, faults in valves and operational errors. A large part of the valve leaks are related to safety valves, most often linked to structural weaknesses

Figure 2.9.2
Area where hydrocarbon leaks occurred

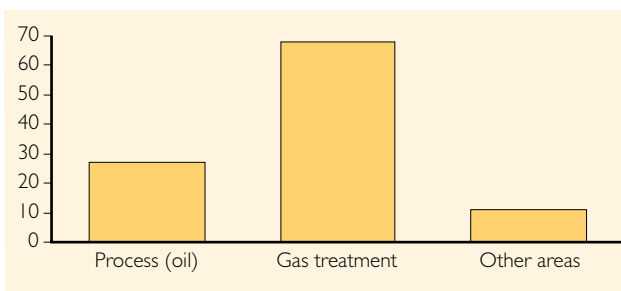
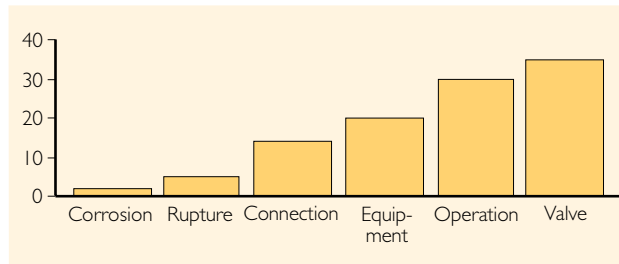


Figure 2.9.3
Main group of faults resulting in gas leaks



associated with the valves. Many of the operational leaks are associated with poor work planning, and some cases of leaks are due to unfortunate design of equipment and systems.

2.9.2 FIRES AND NEAR-FIRES

In recent years, the number of fires with a medium risk potential has remained fairly stable. No fires classified as major have occurred since 1998. Five fires have been assessed as medium-sized based on duration, amount of smoke/flame and emergency preparedness factors. None of the incidents led to personal injuries. Most of the reported fires have been investigated or are being investigated internally in the affected companies. Table 2.9.1 shows the number of reported fires over the past five years, divided by size categories.

Table 2.9.1 Fires and near-fires 1997 - 2001

Year	Small	Medium	Large	Total
1997	22	2	1	25
1998	17	4	1	22
1999	38	4	0	42
2000	75	5	0	80
2001	26	5	0	31

Two of the five fires classified as medium-sized related to fires in electrical equipment, while the other three are the result of flammable material coming in contact with hot surfaces. Two of the fires affected important safety equipment such as fire pumps and emergency switchboard. In one case, fire in a switchboard cabinet led to smoke development in the control room, which was regarded as being a serious incident.

The reporting of minor incidents or near-fires has varied considerably in recent years. Such incidents, where smoke is registered or a small flame or overheated equipment is noted, but without leading to danger to personnel or the installation, shall no longer be reported to the Norwegian Petroleum Directorate according to the new regulations.

Table 2.9.2 shows the distribution of causes of the fires. Hot surfaces and electric faults in equipment were the most common causes in 2001, as in previous years.

The electrical fires were caused by factors such as:

- short circuits in switches, junction boxes or switchboards

Table 2.9.2 Causes of fires distributed by size

Causes	Small	Medium	Total
Electrical	10	2	12
Self-ignition	1		1
Welding	1		1
Temperature	12	3	15
Other	2		2
Total	26	5	31

- faults in electrical equipment (transformers, generators and electrical motors)

Information from the submitted reports can indicate that the underlying/actual causes of fires in electrical equipment are largely linked to deficient maintenance or defects/weaknesses in equipment design.

Ignition on hot surfaces has occurred in connection with:

- rotating equipment (bearings, etc.)
- turbines (exhaust duct)
- tumble dryer

The corresponding underlying/actual causes of fires caused by hot surfaces are linked to maintenance of equipment and errors in connection with planning and executing work. A typical incident in this context is personnel who leave flammable material on or near hot surfaces.

2.10 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 compiled in the CODAM database. In 2001, there were reports of 12 incidents related to load-bearing structures and 13 related to pipeline systems. The database now contains data concerning a

total of 3370 incidents related to load-bearing structures and 2384 incidents related to pipeline systems.

2.10.1 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, depending on the scope of the damage and the criticality.

In 2001, there were three incidents and damage classified as “major” involving pipelines and risers:

- During pressurization with hydrocarbon gas of a 10" oil flow line, gas bubbles were observed on the sea about 350 meters from the installation. The leak from the line was due to a rupture in a welded flange in a pipe connection. Investigations showed that the weld failed due to a brittle fracture.
- A gas leak was discovered from a 12" pipeline system between two installations. The incident led to a production shutdown on the one installation and reduced production from the other. Investigations showed that the leak in this case was also caused by a brittle fracture in a weld on the flange connector.
- On a 6" flexible riser for gas injection, a crack in the plastic cap was discovered at a depth of about 10 meters. The crack was discovered due to gas detection on the installation. The riser was shut down and subsequently replaced.

2.10.2 LOAD-BEARING STRUCTURES

In the same manner as for the pipeline systems, the bulk of the reported damage and incidents relate to load-bearing structures in the categories ‘insignificant’ and ‘minor’. No incidents classified as “major” have been reported in 2001. The reported incidents are largely related to cracks discovered in ballast tanks, cracking of weld connections between columns and deck, as well as cracks in gussets for fastening between fire walls and process equipment.

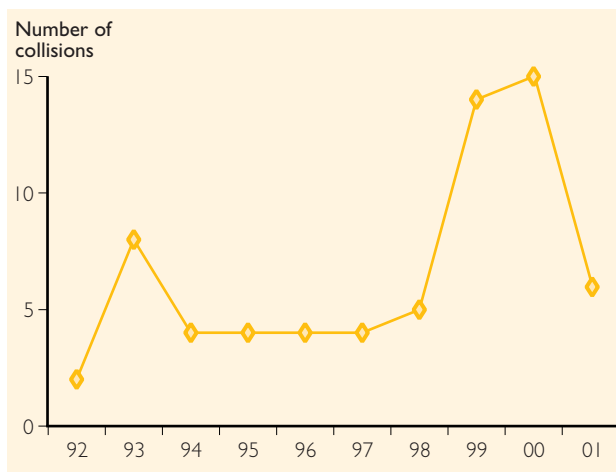
2.10.3 COLLISIONS BETWEEN VESSELS AND INSTALLATIONS

Six collisions between vessels and installations have been reported in 2001.

Compared with the previous years, 2001 showed a marked decline, bringing the figure back to the average level in 1999 and 2000, see Figure 2.10.1. One cause of the reduction in the number of collisions seems to be the attention given to avoiding such incidents and the measures put in place to prevent them. Mobile drilling rigs were involved in three of the collisions, one incident involved a floating production installation, while the other two occurred between vessels and fixed installations.

In one of the incidents, the substructure of a mobile production installation was depressed 10-15 cm. In another incident, the bow railing of a vessel was damaged after

Figure 2.10.1 Collisions between vessels and installations 1992-2001



collision with a mobile drilling rig. The other incidents did not lead to significant damage to the installation or the vessel.

2.11 DIVING

2.11.1 DIVING ACTIVITY

During the course of 2001, 54 surface-oriented dives and 650 bell runs were carried out, amounting to a total of about 73,000 man-hours in saturation on the Norwegian shelf and on Norwegian pipelines on foreign shelves. This is an increase in scope for both surface diving and saturation diving compared with the previous year.

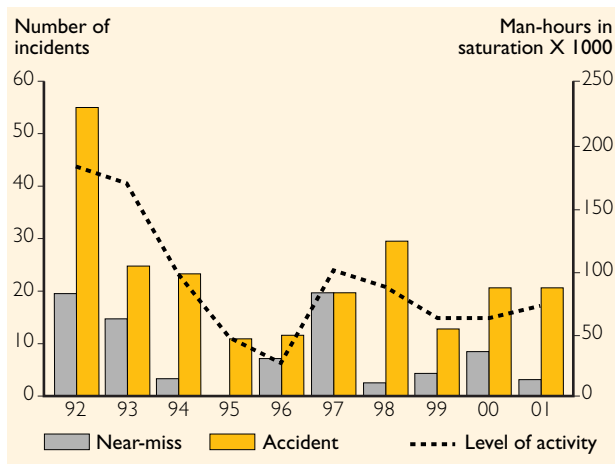
Diving activities have been divided among inspection, maintenance and construction activities on fields where Hydro, Phillips, Statoil and TotalFinaElf are the operators. Diving in connection with construction work has constituted a large portion of the activity.

2.11.2 PERSONAL INJURIES IN CONNECTION WITH DIVING

Figure 2.11.1 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-accident, personal injury 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-accident 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 associated with saturation diving in 2001 is the same as for the previous year, although last year's activity level was lower. Of the 21 reported personal injuries in connection with saturation diving, none were of a serious nature. The majority of the personal injuries (18) were related to infections.

Figure 2.11.1
Incidents in saturation diving



Three near-accidents were reported in connection with saturation diving, all of which are characterized as serious. Two of the incidents related to flaws in the reinforcing cover on the umbilical to the diving bell. The third incident related to water penetration in the helmet of a diver working in the water outside the diving bell.

2.11.3 DIVER TRAINING

No saturation divers were trained in Norway in 2001. During the course of the year, the Norwegian Professional Divers' School and the National Divers' School have trained a total of 93 divers who have been issued Class 1 certificates.

2.11.4 RESEARCH AND DEVELOPMENT IN THE AREA OF DIVING

In 2001, the Norwegian Petroleum Directorate has continued its participation as a member of the board and the project management group in a diving-related research program. 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 2001, the annual diving seminar was held as a joint seminar for both open sea diving and diving in sheltered waters.

2.11.5 INTERNATIONAL COOPERATION WITHIN DIVING

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

2.12 LIFTING GEAR AND LIFTING OPERATIONS

A total of 61 undesirable incidents related to lifting operations were reported to the Norwegian Petroleum Directorate in 2001, compared with 68 in 2000. The number of incidents that led to personal injury increased, however, from nine in 2000 to 17 in 2001. This figure includes all lifting operations, including lifting operations in connection with drilling.

There were no fatalities in the accidents that occurred in 2001. Thus, both of the two fatal accidents that have occurred within the Norwegian Petroleum Directorate's sphere of authority in the last five years have been in connection with lifting operations. Therefore, this type of activity will continue to receive considerable attention in the years to come.

Reporting of such incidents contributes to the Norwegian Petroleum Directorate's basis for evaluating which areas have a potential for improving safety associated with lifting operations. The most important areas are:

- Operational procedures, as well as respect for and compliance with such procedures.
- Attitudes toward and knowledge of safety associated with lifting operations.
- Use of experience gained from accidents and undesirable incidents in the systematic work of improving safety.
- Involvement of technical and operational expertise in the operation and maintenance of lifting gear.

The Norwegian Petroleum Directorate has followed up the conclusions from the project “Causal relations in lifting operation incidents” in its supervision activities. The companies also continue to work on the problem areas revealed in this project, and the Norwegian Oil Industry Association and the Norwegian Shipowners’ Association are coordinating the work through the project “Working together for safety”.

2.13 EMERGENCY PREPAREDNESS

Terrorist attack against the USA on 11 September 2001

Shortly after it became known that terrorist acts had been carried out inter alia against the World Trade Center in New York, contact was established between the Norwegian Police Security Service and the Norwegian Petroleum Directorate. The objective was to establish a channel of information with regard to the threat scenario for Norway in general and the petroleum industry in particular. It was also important that information be received quickly in the event of changes in the threat scenario.

Contact was also established with the individual opera-

ting companies and shipping companies. The companies appointed specific contact persons to ensure that important information could be relayed quickly in the event of a need to take action.

A meeting was held with the industry to identify potential areas that might be especially vulnerable to terrorist acts, particularly in relation to the offshore activities. It emerged that there could be a need to take a closer look at the vulnerability of shipping bases, which could be particularly at risk. A group was appointed to assess the bases’ vulnerability to terrorist acts as a continuation of a mapping that had been carried out previously. The group submitted its report in January 2002.

In addition, the individual operating companies instituted various measures to secure their own activities. The measures included things such as improved control over buildings, stricter access control, travel restrictions, etc.

The extraordinary regular contact between the Norwegian Petroleum Directorate, the Norwegian Police Security Service, the ministries and the industry in general was concluded in December, as the situation had remained stable for some time.

3. Data, Information and Knowledge Management

3.1 DATA, INFORMATION AND KNOWLEDGE MANAGEMENT

The Norwegian Petroleum Directorate's many activities and tasks are based on a diverse landscape of competence and knowledge management. A central function is our role as a data, information and knowledge bank. We occupy a unique position in that we are the only body with access to all important data from the continental shelf. The Norwegian Petroleum Directorate views data and information as resources and key raw materials in the production process. This makes it possible for us to always have a complete overview over the resources on the Norwegian shelf and allows us to describe the status of health, environment and safety, production, costs, emissions/discharges, revenues, values, etc.

We will safeguard and further develop our role as national custodian of data and information related to the petroleum activities, and keeper of the State's "land register" for the continental shelf. This provides a common basis for evaluations and decisions for ourselves, the industry and other authorities.

As regards data and information generated in the petroleum activities, the Norwegian Petroleum Directorate shall contribute to ensure that the data is efficiently stored, quality-assured and made accessible with a view towards value creation and improvement of resource management and the safety level on the Norwegian shelf.

All the Norwegian Petroleum Directorate's activities are based on converting data and information on natural and human factors on the shelf into knowledge. This knowledge is managed by the Norwegian Petroleum Directorate's staff and is continuously employed in the follow-up of individual matters and in strategic evaluations with a more long-term perspective. Another central task of the Norwegian Petroleum Directorate is to contribute to good communication in common arenas and in projects for knowledge development in cooperation with the industry and research institutions. The Norwegian Petroleum Directorate believes that it is very important that important elements of this knowledge are also communicated to other users, the public and the media.

3.2 FIELD OF ACTIVITIES AND RESULTS IN 2001

In 2001, the Norwegian Petroleum Directorate organized all data, information and knowledge management into a single product area with special focus on the performance goal of maximizing the factual basis for decisions. This applies to all phases of the petroleum activities and also encompasses focus on minimizing the costs of data access. The products under this performance goal are a prerequisite for handling the Norwegian Petroleum Directorate's and the ministries' many tasks. The final products related to the performance goals are obviously expressed in the first two chapters of the annual report. The following section also focuses on

some central tasks carried out in 2001 in the value chain of data, information and knowledge-based decisions. In addition, key elements of information communication and central cooperative bodies are described.

A comprehensive review has been carried out of the Norwegian Petroleum Directorate's play models on the Norwegian shelf.

National databases for prospects, discoveries and fields, resource estimates and production have been further developed and continuously updated in 2001. The Norwegian Petroleum Directorate plays an important role in connection with assuring the quality of data reported to the national budget.

A separate resource report has been prepared for 2001. A large edition has been published and this has led to many inquiries and a good dialogue on the industry's future prospects.

Uninterpreted resource data from more than 300 exploration wells has been released upon request and a number of studies of geological samples have been conducted by the industry in the Norwegian Petroleum Directorate's viewing room - a total of 176 visit days.

The Norwegian Petroleum Directorate has collected and recorded data within the areas of personal injuries, work-related diseases, diving, undesirable incidents, gas leaks, fires and near-fires, inspection statistics for pipelines and structures. The Norwegian Petroleum Directorate has contributed to the dissemination of information on damage data on installations and updated statistics are made available on the Norwegian Petroleum Directorate's web site.

The Norwegian Petroleum Directorate has coordinated and automated processes in connection with notification and reporting of accident incidents, and has a constructive dialogue with the industry to further develop a model for risk development. This work is described in detail in Chapter 2 of the annual report.

The Norwegian Petroleum Directorate's web site on the Internet (www.npd.no) averaged 100 000 hits per month in 2001. This is twice the amount of hits experienced in 2000. Feedback from the industry indicates that a lot of information is extracted from the Norwegian Petroleum Directorate's fact pages. External users have been pleased by the accessibility of data on wells and production licenses. Inter-disciplinary work has taken place to make quality-controlled data available from some of the most interesting wells on the Norwegian shelf (Well Data Summary Sheet). This is an example of 24-hour stewardship in practice, and this communication of information is more efficient than replies via telephone or letter.

An updated map of wells and production licenses is published on the Norwegian Petroleum Directorate's web site each week.

A registration form has been prepared and put into use on the Internet for new wells. 165 registrations have been made of new wells.

The Norwegian Petroleum Directorate has developed a better system for press releases on exploration wells. This has led to the press releases becoming more consistent and that external users can gain easier access to an overview on the Internet.

The flow of information between the Directorate and the industry is described in the regulations. In the new regulations that entered into force on 1 July 2001 and 1 January 2002, there is a provision allowing electronic communication between the authorities and the players where this is deemed appropriate. The new rules on data and the information area are found in the Resource Regulations for the resource management area and in the Information Duty Regulations for the HSE area.

As a consequence of this, the Norwegian Petroleum Directorate has established an electronic archives and electronic distribution of files.

The Norwegian Petroleum Directorate has contributed to the Ministry of Petroleum and Energy's fact sheet and sends reports concerning the petroleum activities on the shelf to the Ministry of Petroleum and Energy on a weekly basis, and to Statistics Norway on a monthly basis.

In Storting White Paper No. 39 (1999-2000), provision was made allowing the companies to request an advance evaluation of a potential role as operator and/or licensee on the shelf without having agreed on purchase of an interest in a production license. The Norwegian Petroleum Directorate has evaluated 11 companies under this system in 2001.

The Norwegian Petroleum Directorate has played a central role in the handling of the data flow in the process of selling the SDFI interests, the formation of Petoro and in the work on annual North Sea rounds and a new round of awards.

The Norwegian Petroleum Directorate has worked actively on a base for daily drilling operations (CDRS) - particularly with strategies linked to ownership interests and sale of software.

Starting from 1 January 2002, the shelf regulations were made available in electronic format, free of charge, from the Norwegian Petroleum Directorate's web site. A substantial amount of work has been done to compile the regulations and make them accessible.

The Norwegian Petroleum Directorate has the role of observer in the branch network SOIL.

The information activities in the Norwegian Petroleum Directorate in 2001 were marked by reorganization. Various models for internal and external communication of information were tested. As a result of this, three editorial working teams were established; D-Public Affairs, D-Shelf publications and D-Net info. These teams have the overall responsibility for selecting, prioritizing and/or processing of information to external users.

As part of this reorganization, the Norwegian Petroleum Directorate has decided to increase its commitment to the Internet. A comprehensive development of the web site

and its contents has been initiated. At the same time, the number of printed publications has been reduced. The main publications are the annual report, alternating resource and HSE report every other year, as well as four editions of the Norwegian Petroleum Directorate's quarterly periodical, "Norwegian Petroleum Diary". A brief presentation of the Norwegian Petroleum Directorate's printed publications may be found on www.npd.no.

The Norwegian Shelf 2001, the Annual Report, is a key publication for the Norwegian Petroleum Directorate. The publication is the official standard account of the activities on the Norwegian continental shelf. The document is now supplemented by tables and summaries on the Norwegian Petroleum Directorate's web site.

The published edition of the Annual Report was released in May 2001 (Norwegian version). The English edition was published in June. Both are issued free of charge.

2001 was the fourth year for "Norwegian Petroleum Diary", which was issued in March, June, September and December. The goal of "Norwegian Petroleum Diary" is to highlight the activities on the Norwegian shelf, the main features that characterize the Norwegian oil and gas industry and the Norwegian Petroleum Directorate's role as administrative body. This is done by analyzing the background, ripple effects, connections and challenges in and for the industry. The target groups are Norwegian and foreign authorities, oil companies, general business and industry, politicians, educational institutions, trade unions, the press and society at large.

The publication is also issued in parallel in English under the name Norwegian Petroleum Diary. Both versions are available in both hard copy and electronic versions. The total circulation for the printed version is 9 000 copies. Subscriptions are free.

The Norwegian Petroleum Directorate issued 50 press releases during 2001. 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's printed version of the continental shelf map is in great demand. The map was issued in June 2001 with an overview of all production licenses on the Norwegian shelf as of the same date.

The Nordic reference database OIL had a circulation of approx. 30 000 last year. There was an average of about 2 500 notices 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: <http://www.npd.no/oil>.

Seventeen publications are available in full text format via the Norwegian Petroleum Directorate's web site: http://www.npd.no/engelsk/infoserv/publ/con_publ.htm

At year-end, the Publication List contained 177 publications, ten of which were new.

915 applications have been received for access to documents under the Freedom of Information Act, i.e. access to about 2 200 files. This is an increase of ten 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». At the turn of the year the Directorate started using complete electronic archives.

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 2001 was to provide for electronic processing, both internally and between the Norwegian Petroleum Directorate and other activities. The Norwegian Petroleum Directorate started using a new electronic file system for internal distribution of files, and the LicenseWeb tool for electronic cooperation with the petroleum industry.

3.3 PROJECTS

3.3.1 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. It was proposed in the autumn of 1999 that the FIND cooperation forum be merged with FORCE. In the autumn of 2001, the members of the forum decided to continue FORCE for another three years.

There are now 22 members in FORCE, including the Norwegian Petroleum Directorate and the Research Council of Norway. All members are represented on the board, where Statoil held the chair until the end of 2001. The secretariat is located in the Norwegian Petroleum Directorate.

The main goal of FORCE is to contribute to increasing 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 research institutions and the supplier industry. 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 Modeling 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 have been held in 2001 and work is underway on concrete project proposals. The following seminars/workshops were organized in 2001:

- Offshore Norway Tidal Environments – Core Workshop
- Basics of statistics and uncertainty and applications in resource evaluation and risking.
- Multiphase Upscaling
- Key Uncertainties from Seismic to Geomodelling
- Deep Marine – Core Workshop
- Chlorite coatings in Siliciclastic Reservoirs
- Value of Smart Wells
- Imaging of Sub-basalt areas using long offset seismic data.

A total of 2 516 persons have participated in FORCE seminars/workshops since 1995. 780 of these attended in 2001.

For more information on FORCE and the activity in the committees, please check the web site www.force.org.

FUN

FUN (*Forum for Forecasting and Uncertainty 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 the 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 secretariat is located in the Norwegian Petroleum Directorate.

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 One is to focus on improved information and reporting routines among the companies and between the companies and the authorities. Working Group One shall also be the forum for changes in connection with reporting for the national budget. Working Group Two is responsible inter alia for initiating and being a program committee for workshops and seminars for managers and technical personnel. In addition, projects will be initiated through this working group. There are two networks under Working Group Two: «Reservoir EXplotation - REX», and «Systematic Treatment of Uncertainty for Decision Making -STUD».

In 2001, 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-making 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 half of 2000. Twelve oil companies, the Ministry of Petroleum and Energy and the Norwegian Petroleum Directorate participate in the project. Representatives from the companies' offices in Norway, as well as some of the headquarters of foreign companies were interviewed. In addition, representatives of 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 a Management seminar on 15 November 2001: «Gas and Oil Resource Management in a Deregulating Gas Market».

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 national 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. In addition to seismic data, the DISKOS database contains quality-controlled well data and production data. The database also has the functionality to administrate data swaps between the oil companies through the PetroBank Trade module. Statoil-Trade was responsible for data swaps until 31 December 2001. The Norwegian Oil Industry Association (OLF) took over this task starting in 2002.

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 through the DISKOS project, while responsibility for further development has now been assumed by Landmark Graphics. PetroBank® is POSC (Petrotechnical Open Software Corporation) compatible, i.e. an open solution that communicates with various end user technologies. The software is continuously upgraded with new functionality for all types of data.

Work continued in 2001 to load all historical well data from the Norwegian shelf into the database. The DISKOS group has also negotiated a new business model for post-stack seismic data that will enter into force starting from 2002. The goal is also to store all relevant processed versions of post-stack seismic data.

The Norwegian Petroleum Directorate delivers quality-controlled administrative data to the database on a weekly basis. This data relates to production licenses, blocks, fields, seismic navigation, well locations, pipelines, etc. The database now contains approximately 50 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 in Stavanger.

3.3.2 PARTICIPATION IN RESEARCH AND TECHNOLOGY DEVELOPMENT PROGRAMS

In 2001, the Norwegian Petroleum Directorate has been involved in several public research programs 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 work was concluded with a report in February 2001. The program will be continued with a new board and secretariat that were established in the summer and autumn of 2001 respectively. The Norwegian Petroleum Directorate is represented on the board.

Oil and gas / Offshore 2010

The research program Oil and Gas started in the autumn of 2001 and encompasses user-controlled innovation projects for development of new solutions, processes and products within the oil and gas activities. The program is administered by the Industry and Energy Section (IE) in the Research Council of Norway. The Norwegian Petroleum Directorate participates on the board of the Oil and Gas project. This program replaces the previous research program **Offshore 2010**, which was concluded in the spring of 2001, and where the Norwegian Petroleum Directorate also participated in the board work. Among other things, the board of Offshore 2010 had a report prepared on quantification of the value potential associated with additional research in the petroleum activities. This report, the VERTEKS report, has formed the basis for much of the continued work, discussion and argumentation, such as in OG21, for prioritizing more state funds for petroleum research in Norway.

Petroforsk

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

Petropol

Petropol is a research program that addresses internationalization, change and new challenges for the Norwegian petroleum industry. The program is administered by the Cultural and Social Section (KS) in the Research Council of Norway. The Norwegian Petroleum Directorate is a member of the program 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 program and SINTEF has the secretariat. The Norwegian Petroleum Directorate is an observer on CORD's board of directors.

Centre for Operations and Maintenance

The Centre 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 University College (HiS) is responsible for the technical aspects. The Norwegian Petroleum Directorate participates on the technical council for the foundation.

DEMO 2000

Project-oriented 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.

3.3.3 OTHER PROJECTS

The Norwegian Petroleum Directorate's mapping of the borders of the Norwegian continental shelf

The UN Convention on the Law of the Sea gives coastal states the right to draw up the boundaries of the continental shelf beyond the exclusive economic zone of 200 nautical miles. Norway ratified the convention in June 1996 and must present its claim with regard to this outer boundary 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, collection and processing of bathymetric (water depth) and seismic data were carried out in the Norwegian Sea and the Arctic Sea respectively in 2001, see Figures 3.1.1 and 3.1.2.

The bathymetric measurements were carried out with the aid of multi-wave echo sounders. 60 500 square kilometers were covered with such data, with the main emphasis along the Mohns ridge northeast of Jan Mayen (a total of

271 500 square kilometers have been covered over the past three years).

Multichannel reflection seismic data and sonar buoys (refraction seismic) were collected in the Arctic Sea, primarily in ice-covered areas. A total of 1160 km multi-channel reflection seismic and 51 sonar buoys were collected. The

exploration was carried out using the Swedish icebreaker Oden. Collection of the data was done in cooperation with the Institute of Solid Earth Physics, the University of Bergen, which had technical responsibility for the work, assisted by the Department of Geology, the University of Oslo.

Figure 3.1.1
Multi echo sounder coverage

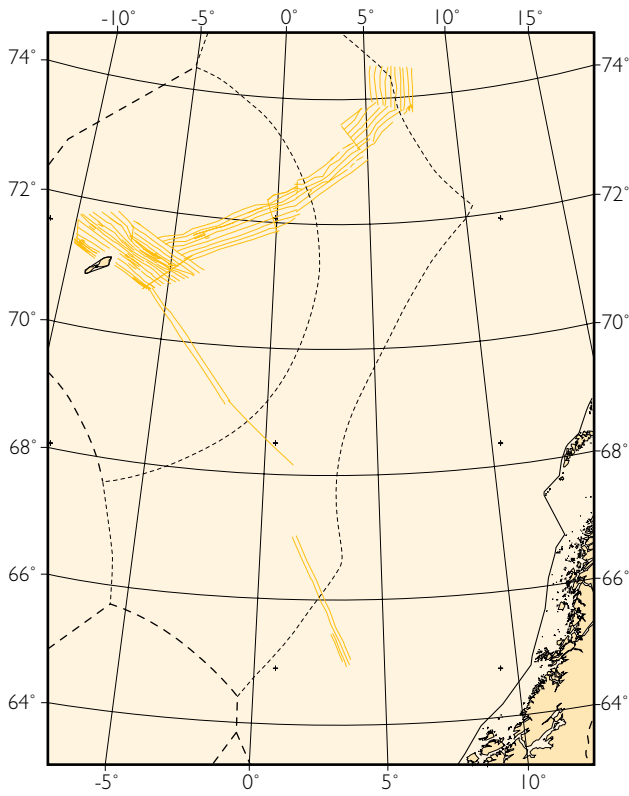
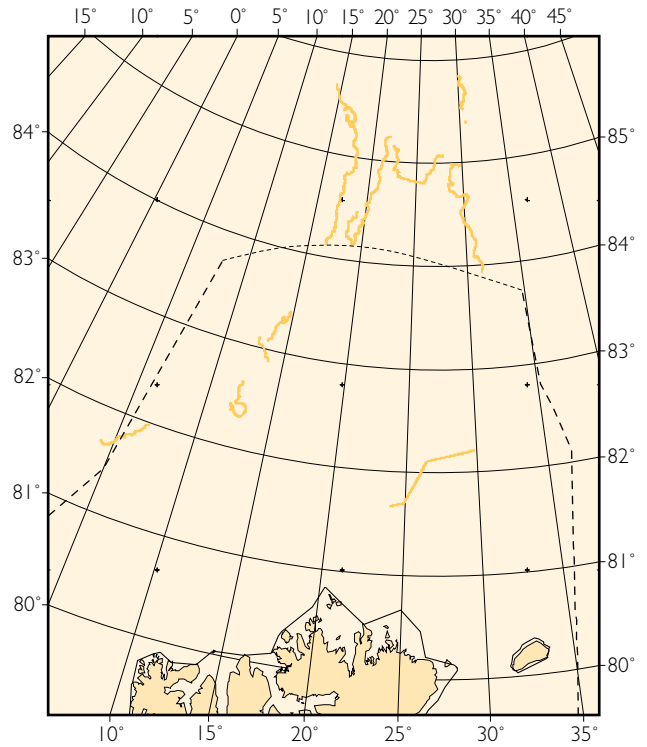


Figure 3.1.2
Seismic coverage



4. Environmental Measures in the Petroleum Activities

4.1 CONSIDERATION FOR THE ENVIRONMENT

Consideration for the external environment 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.

4.2 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 CO₂ 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 values.

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.

Together with the Norwegian Pollution Control Authority and the Norwegian Board of Health, the Norwegian Petroleum Directorate has in 2001 completed the work on revision of regulations in areas which deal with safety, working environment, health and the external environment. The new regulations entered into force on 1 January 2002 and will be enforced by the three authorities jointly.

4.3 SUPERVISION OF THE ACTIVITIES

Security against pollution is also covered under the safety concept as it is applied in the petroleum activities. Supervision of environmental measures and environmental activities is an integral part of the Norwegian Petroleum Directorate's supervision activities. 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 the companies' acceptance criteria goals.

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 CO₂ 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 CO₂ emissions.

4.4 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.

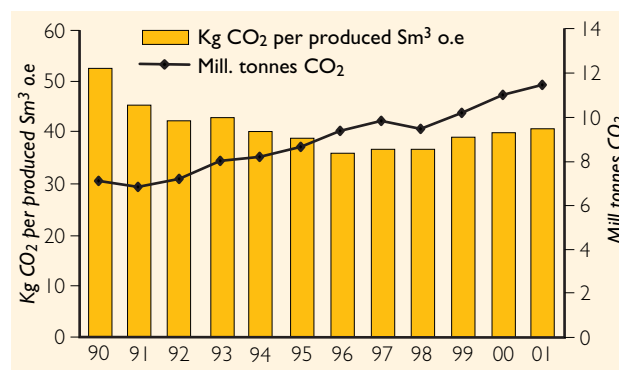
In 2001, the Norwegian Petroleum Directorate considered and made recommendations in respect of nine new field and pipeline developments. The possibility of implementing various environmental measures was a central aspect of the Directorate's evaluation of these plans. In cooperation with the Norwegian Pollution Control Authority, the Norwegian Petroleum Directorate has carried out environmental supervision aimed at the development of the Kristin field.

Together with the Ministry of Petroleum and Energy, the Norwegian Petroleum Directorate has again in 2001 prepared a publication that provides an overview of environmental aspects on the Norwegian shelf: "Environment 2001. The Petroleum Sector in Norway".

The cooperation between the authorities and the industry that took place under the direction of MILJØSOK has been continued in the Environmental Forum (Miljøforum) in 2001. The first meeting in the Environmental Forum took place in the autumn of 2001.

Within the arena of international cooperation under the Oslo and Paris Convention (OSPAR), the participating countries seek, among other things, to arrive at common

Figure 4.1.1
Emission of CO₂ per Sm³ o.e



standards and goals for reducing discharges to sea. Together with other Norwegian authorities, the Norwegian Petroleum Directorate has contributed to this work which in 2001 resulted in resolutions for reduced discharge of oil in produced water by 2006.

In cooperation with a number of operators, the Norwegian Petroleum Directorate has started an evaluation of the potential for using CO₂ for injection into oil fields to improve recovery. The work will initially be concentrated on the Brage, Ekofisk and Gullfaks fields. Based on the results of this work, the Norwegian Petroleum Directorate will map the potential for improved oil recovery from CO₂ injection on the Norwegian continental shelf.

4.5 EMISSIONS/DISCHARGES FROM THE ACTIVITIES ON THE SHELF

The most important emissions to air from the activities on the Shelf are CO₂, NO_x and volatile organic compounds (nmVOC and methane). In addition come discharges or chemicals, oil and other organic components to the sea. Each year, the Norwegian Petroleum Directorate compiles historical emission/discharge data and prepares forecasts for the activities with main emphasis on emissions to air and produced water. The emission/discharge data is an important basis from which to evaluate policy instruments so that national and international commitments may be followed up in a cost-effective manner. For up-to-date emission trends, please refer to the Ministry of Petroleum and Energy's web site and to the publication "Environment 2002. The Petroleum Sector in Norway".

Emissions of carbon dioxide (CO₂)

Preliminary figures from the Norwegian Petroleum Directorate show that the total CO₂ emissions from the shelf increased from 11.1 to 11.5 million tonnes from 2000 to 2001. Taxable CO₂ emissions, which consist of emissions from the production installations, accounted for about 89 percent of the total emissions from the shelf in 2001. The remaining 11 percent are divided among emissions from gas terminals (two percent), mobile drilling installations (three percent) and from process emissions (six percent).

A higher level of total emissions does not mean that there have not been improvements as regards the environment. However, improvements in energy exploitation and reduced flaring have not been great enough to make up for the increased energy consumption resulting from a higher activity level. An indication that the activities have become more efficient are that the emissions per sold unit of petroleum are increasing less than the increase in the total emissions. While the total CO₂ emissions from the shelf increased by 4.5 percent from 2000 to 2001, the emissions per sold unit of petroleum increased by just one percent, as shown in Figure 4.1.1.

The emission sources from the production installations in 2001 are shown in Table 4.1.1 where natural gas for fuel

Table 4.1.1 CO₂ emission sources 2001

Emission source	Percentage 2001	Percentage 2000
Fuel gas	82	78
Flaring	13	17
Diesel	5	5
Total	100	100

shows an increase while the volume of flare gas has declined compared with corresponding figures for 2000.

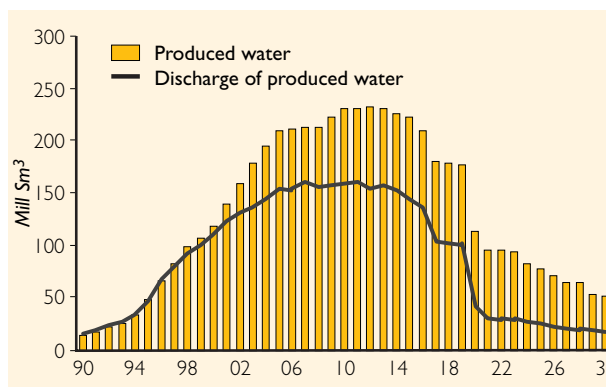
The work on nitrogen oxides (NO_x)

In the operations phase, emissions of NO_x are not yet regulated on the continental shelf other than in any conditions stipulated in connection with consideration of the PDO. In 1999, Norway signed the international Gothenburg Protocol which inter alia stipulates requirements for reduction of national NO_x emissions equivalent to a 29 percent reduction in 2010 compared with the 1990 level. In 2001, the Norwegian Petroleum Directorate implemented and led a working group examining measures and costs associated with reducing the emissions of NO_x from production installations on the shelf. The report from the work shows that there are several different technologies that can reduce the emissions, but that the costs are generally high and vary considerably from installation to installation. To help ensure that the most cost-effective measures are implemented, the Norwegian Petroleum Directorate conducted a preliminary study in 2001 to evaluate the possibilities of a quota system for NO_x emissions on the shelf as a potential policy instrument. The report has been a key contribution to the ministries' process of formulating an effective regulation for NO_x emissions.

The work on volatile organic compounds (nmVOC)

In 2001, the Directorate has participated in the authorities' final formulation of emission permits in order to reduce the emissions of oil vapor (nmVOC) from the storage and loading of oil on the shelf.

Figure 4.1.2 Produced water and discharge of produced water



Produced water

Preliminary figures indicate that water production on the Norwegian shelf in 2001 was 18 percent higher than the previous year, while the discharges of produced water increased by 11 percent during the same period. As shown in Figure 4.1.2, water production is expected to climb until 2012, however, an increasingly larger portion of the produced water will be reinjected.

There has been a positive trend in 2001 in the use of improved purification methods for produced water that is discharged to sea.

The Directorate has cooperated with other authorities and the industry on implementation of the zero discharge philosophy.

4.6 GREENING OF GOVERNMENT – GREENING OF NPD

From 1998-2001, the Norwegian Petroleum Directorate participated in the Greening of government pilot project started by the Ministry of the Environment and the Ministry of Labour and Administration. The paramount goal of

the project has been to reduce the consumption of resources and the environmental burden in public administration. Through the project, the objective was to gain experience in the integration of environmental considerations in ten state-owned enterprises. The experiences gained, which are in large part documented on the web site www.miljo.no/gronnstat/, have formed the basis for the decision to extend Greening of Government to other public bodies and activities in 2002.

Based on an action plan, the Norwegian Petroleum Directorate implemented several environmental measures during the course of the project period. These are documented in an experience report which can be obtained upon inquiry to the Norwegian Petroleum Directorate. The environmental report for the Norwegian Petroleum Directorate's internal operations in the year 2000 was published in May 2001 and showed that increased environmental efficiency was achieved during the project period, and that several of the measures have also led to financial savings in the Directorate. Examples of implemented measures include application of video conferences and energy efficiency measures in the Norwegian Petroleum Directorate's buildings.

5.1 COOPERATION WITH NORAD

In 2001, the Norwegian Petroleum Directorate's assistance work financed by NORAD amounted to approximately six man-years. The majority of the assistance has been directed towards the following cooperating countries: Angola, Namibia, 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). As regards the majority of the projects, institutional cooperation agreements have been entered into with sister organizations in the south, providing an opening for assistance within an extensive part of the Norwegian Petroleum Directorate's sphere of activities, both technically and administratively. Training and establishing a legal framework for the petroleum activities are central elements of all projects.

The Norwegian Petroleum Directorate also assists NORAD in connection with the preparation of new national strategies, evaluation of new project proposals, and also cooperates with other governmental institutions (the Norway axis) on executing this type of project. Future cooperation with Nigeria and East Timor is currently being considered.

Angola (Ministry of Petroleum MINPET)

This is a three-year cooperation program started in the autumn of 2000. An advisor from the Norwegian Petroleum Directorate has assisted MINPET in their work, and has also assisted in the implementation of the program. The main activity has been aimed at assistance in the development of regulations within the HSE area, as well as within resource management. A number of delegations from Angola have visited Norway to discuss experiences, including in relation to macro-economic management of the sector and increased national participation in the petroleum activities.

Namibia (Ministry of Mines and Energy – MME)

The main activity in MME is aimed at organizing the future development of the country's substantial gas resources. Shell is working actively on plans to develop a large offshore gas field, Kudu. During last year's program, assistance was also provided towards the development of statutes and regulations for the development and production of natural gas. Last year's work program has also included further training in supervisory methodology and assistance in connection with promoting exploration activity. The Norwegian Petroleum Directorate has an advisor stationed with MME in Winhoek.

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 started in the spring of 1999 was largely completed in 2001. A decision has been made to implement a phase two with largely the same focus as phase one.

SADC

Limited cooperation has been established with Southern African Development Community (SADC) to assist them in the process of converting SADC TAU (Energy Sector: Technical and Administrative Unit, Luanda) into an energy commission. The final form of the commission's work has not been determined and it is possible that some of the functions will be moved to the SADC headquarters in Gabrone.

Mozambique (National Directorate for Coal and Hydrocarbons – NDCH)

NDCH has received support to complete the work on regulations for the petroleum sector under the new petroleum act. The Norwegian Petroleum Directorate has also assisted in consideration of the development plan for the Pande and Temane gas fields and the associated transportation system for gas to Secunda in South Africa (approx. 700 km). The plans were approved by the Parliament in Maputo at the end of the year. Consultants have assisted in negotiations with Sasol/ENH, which are to implement the project. The national data archives for the petroleum sector is now in full operation and installation of interactive interpretation stations is being prepared. Significant training has been provided to NDCH in the areas of resource planning and supervisory activities. A decision has been made to continue the program for another four years.

The Norwegian Petroleum Directorate has also assisted Empresa Nacional de Hidrocarbonetos (ENH), the national state oil company, in obtaining consultant support for negotiations with Sasol on development of the gas fields.

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 (HCU) under the Ministry of Energy and Mineral Resources, which is the Norwegian Petroleum Directorate's cooperating organization. The main work in the current phase of the project is aimed at the development of expertise within resource mapping, resource evaluation and data management. HCU has recently presented new estimates for gas resources that will be extremely important when considering possible gas exports from Bangladesh.

Vietnam

The Norwegian Petroleum Directorate has entered into a new agreement with Petrovietnam for continued assistance on the development of safety regulations and training in the area of safety management. The Norwegian Pollution

Control Authority cooperates with the Norwegian Petroleum Directorate and will continue its environmental project with Petrovietnam.

It is expected that a decision on a continuation of a previous project "Vietnam Total Resource Assessment" will be made in early 2002. The Norwegian Petroleum Directorate has assisted Petrovietnam in project planning.

Nicaragua (Instituto Nicaragüense de Energía INE)

The project is being continued at a low level and the assistance is directed towards promotion of blocks for the first announcement round.

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 professional 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. At the end of the year, it became clear that the proposed new program »Petroleum Policy and Management« will be implemented as a continuation of the cooperation with CCOP.

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 nearing completion at year-end. PETRAD has conducted a seminar entitled »Management of Natural Gas pipelines« in Manila and the Norwegian Petroleum Directorate plans a certain amount of assistance to the DOE when following up development projects.

5.2 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 to inquiry and need by 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 2001, 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 36 nations.

The Norwegian Petroleum Directorate has also contributed to the implementation of the following seminars in 2001:

- «Management of Operations of Gas Pipeline Systems», Baku, Azerbaijan
- «Management of Operations of Gas Pipeline Systems», Manila, Philippines

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.

5.3 COOPERATION WITHIN RESOURCE MANAGEMENT

Annual meetings with the authorities in the North Sea area

As an oil and gas province, the North Sea is 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. The objective of the meetings is primarily to exchange opinions and experience from the

respective activities. This particularly applies to areas that cover environmental issues, data management, improved recovery, development of small fields and unitization.

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.

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 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 responsibility for hosting the meetings is on a rotation basis among the various countries. In 2001, the event was held on the Faroe Islands in advance of the first drilling campaign in Faroe waters.

Cooperation with Russian authorities Norwegian - Russian forum

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 2001, several seminars relating to this cooperation have been carried out under the direction of the Russian Ministry of Energy.

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. Twelve countries currently participate, and the cooperation largely consists of a commitment for a certain scope of research in specific areas and the exchange of results.

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

Lecture activities

Also in 2001, 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. 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.

In 2001, the Norwegian Petroleum Directorate has again prioritized participation in various events to recruit young people to take their education in petroleum-related subjects. This is a result of the fact that the number of students taking technical and geological subjects has declined dramatically in recent years, as well as the fact that we see an aging of the workforce within both land and offshore-based activities in the petroleum sector. This gives the authorities grounds for concern with a view towards the technical challenges facing us in the years to come.

5.4 COOPERATION WITHIN HEALTH, ENVIRONMENT AND SAFETY MANAGEMENT

5.4.1 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 2001 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 Electro-technical 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 works towards mutual acceptance of methods of documenting compliance with national regulatory requirements. 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 for the first time 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 received positive feedback. Based on these experiences, a decision was made to implement a new international audit, which was carried out in 2001. The overall experiences from such joint audits are considered to be very positive, both with regard to the development of a common understanding of the countries' different regulatory and supervision strategies, and with regard to the actual findings and observations made. 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.

The other group, which has a Danish chairman, is working to achieve mutual acceptance of the requirements for safety training in the various North Sea countries. Previously, the member countries have agreed on which elements of the training programs are mutually acceptable and in which areas there are different requirements. In 2001, the working group has assessed 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 who 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 relevant technical issues, regulatory development, 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 United Kingdom 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

Commission'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.

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 programs, 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.

5.4.2 COOPERATION WITH RUSSIAN SUPERVISORY AUTHORITIES - "THE BORIS PROJECT"

The cooperation with the Russian supervision agency Gosgortekhnadzor continued in 2001. The Russian authorities want to increase their expertise in safety management and supervisory methodology. Through seminar activity and implementation of supervision according to Norwegian principles and methods, Gosgortekhnadzor personnel gain insight into the supervision methods employed on the Norwegian shelf.

Supervision in 2001 was implemented on a part of the pipeline, control room and tank facility of the Caspian Pipeline Consortium at Novorossisk on the coast of the Black Sea. The topic of the supervision was safety management on this section of the pipeline, with particular emphasis on the degree to which the organization was ready for the transition from project to operations phase.

Norwegian Petroleum Directorate representatives participated as advisors to the Russian authorities' representatives and both the company in question and the authorities expressed a positive attitude towards such cooperation between Russian and foreign authorities.

6.1 ACTIVITY PLAN

The annual activity plan is formulated on the basis of requirements and guidelines from superior ministries. The plan contains governing goals, performance goals, performance indicators and priority tasks assigned by the Ministry of Petroleum and Energy and the Ministry of Labour and Government Administration.

An excerpt illustrating the Norwegian Petroleum Directorate's goal structure is found below:

Governing goals

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.

Performance goals

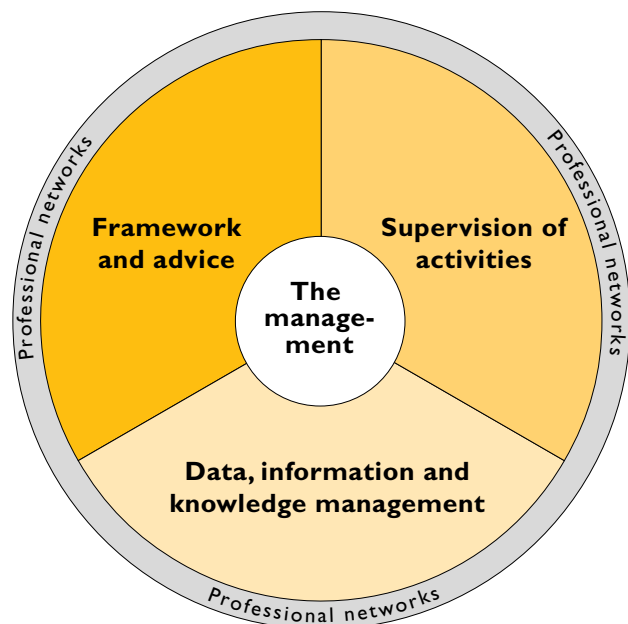
- 1. Maximize cost-effective exploration**
 - 1.1. Maximize resource growth per exploration well, discovery rate, and timely exploration
 - 1.2. Minimize exploration costs per resource growth
- 2. Maximize cost-effective extraction of petroleum**
 - 2.1. Maximize the recovery rate on the individual field and extraction of marginal resources
 - 2.2. Minimize investment costs per reserve unit and operation costs per produced unit
- 3. Maximize cost-effect exploitation of infrastructure and coordination across license boundaries**
 - 3.1. Maximize the exploitation ratio for process capacity and transport capacity
 - 3.2. Minimize investment costs per capacity and operations costs per capacity
- 4. Maximize factual basis for decisions**
 - 4.1. Maximize the decision basis in all phases
 - 4.2. Minimize the costs of data access
- 5. Minimize personal injuries and maintain and further develop a good and prudent working environment**
- 6. Minimize emissions/discharges that are a burden on the external environment**
- 7. Minimize costs associated with the risk of material damage and unintentional operations disruptions**
 Explanation and amplification of performance goals five, six and seven:
 The Norwegian Petroleum Directorate shall maximize its efforts in the petroleum activities to contribute to:
 1. good culture manifested through attitudes, understanding and action
 2. a good overview of risk factors
 3. good management
 4. capturing lessons learned and continuous improvement
 5. employee participation

6. improvement of the elements that constitute a good working environment
7. reduction of the likelihood and consequences of accidents, inter alia with the aid of effective barriers and optimal preparedness
8. prudent technical condition
9. prudent implementation of activities and sufficient expertise and capacity in relation to the tasks

6.2 ORGANIZATIONAL CHANGES

The Directorate reorganized its activities during the course of 2000. The objective is to develop a Directorate that can meet the challenges in the petroleum activities in the future and still contribute to creation of value in the Norwegian society. In 2001, the focus has been on implementing this new, team-based organization. Figure 6.1.1 shows the Norwegian Petroleum Directorate's organizational structure.

Figure 6.1.1
The Norwegian Petroleum Directorate's organizational structure



The Norwegian Petroleum Directorate has in many ways contributed its experiences from the reorganization process, selection of organization form and experiences with the operation of such a team-based organization in several national conferences and in dialogue with a number of other governmental agencies.

6.3 STAFF

At the end of 2001, the Norwegian Petroleum Directorate had 340 employees. An additional 20 employees were on leave. Fifty-seven per cent of the employees are men and 43 per cent are women.

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

26 permanent employees have left their positions, five of these as retirees.

Thirty per cent of managers were female. 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.

6.4 BUDGET AND ECONOMY

EXPENSES

A total of NOK 311.1 million was spent on the Norwegian Petroleum Directorate's operations in 2001. The amount was appropriated as follows:

Wages/compensation incl. employer's contribution	155 282 228	
Goods and services	83 605 526	
Total operating expenses, Item 01		238 887 754
Wages/compensation incl. employer's contribution	5 625 021	
Supervision expenses	11 172 273	
Assignments and cooperation	38 202 354	
Surveys	26 597 116	
Total special operating expenses, Item 21		81 596 764
Major equipment purchases, Item 45		6 918 356
TOTAL EXPENSES, Chapter 1810		327 402 874

1) Includes expenses for Norad, Boris, PetroData and Force

In connection with the reporting for the National Accounts 2001, the Norwegian Petroleum Directorate has applied for transfer of funds to 2002, cf. authorizations granted in the Award Letter for 2001, regarding the following items:

Chapter 1810, item 01	NOK 653 000
Chapter 1810, item 21	NOK 194 000

REVENUES

In addition to paid production royalties, area fees and CO₂ taxes totaling NOK 6.32 billion, the Norwegian Petroleum Directorate received NOK 103.5 million in miscellaneous revenues under Chapter 4810.

Fee and tax income	2 312 262
Assignment and cooperation income	42 294 451
Reimbursement of supervision expenses	47 770 774
Sale of survey material	0
Sale of publications	644 193
Misc. income	1 667 444
Income kindergarten	3 352 115
Reimbursements	796 527
Reimbursement labor market measures	286 154
Maternity benefit	1 213 419
Employer's contribution	171 086
Reimbursement apprentices	210 000
Reimbursement of sick pay, wages	2 475 439
Reimbursement of sick pay, employer's contrib.	349 050
TOTAL INCOME, Chapter 4810	103 542 914