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Report

on behalf of the Committee on the Environment, Public Health and Consumer Protection

on the prevention of disasters during the extraction of oil and gas in North-West European waters

Rapporteur: Mrs J.R.H. MAIJ-WEGGEN

On 19 September 1979 Mr Muntingh tabled a motion for a resolution, pursuant to Rule 25 of the Rules of Procedure, on the prevention of disasters during the extraction of oil and gas in north-west European waters.

On 24 September 1979 the European Parliament referred the motion for a resolution to the Committee on the Environment, Public Health and Consumer Protection.

On 11 October 1979 the Committee on the Environment, Public Health and Consumer Protection appointed Mrs Maij-Weggen rapporteur.

It considered the motion for a resolution at its meeting of 1 October 1980 and unanimously approved the motion for a resolution and the explanatory statement.

Present: Mr Collins, chairman; Mr Johnson, vice-chairman; Mrs Weber, vice-chairman; Mrs Maij-Weggen, rapporteur; Mr Ceravolo (deputizing for Mr Segre), Mr Forth (deputizing for Sir Peter Vanneck), Mr Ghergo, Miss Hooper, Mrs Lentz-Cornette, Mr Key (deputizing for Mrs Fuillet), Mr Mertens, Mr Muntingh, Mr Remilly, Mr Sherlock, Mrs Spaak, Mrs Squarcialupi and Mr Verroken.

C O N T E N T S

A

The Committee on the Environment, Public Health and Consumer Protection hereby submits to the European Parliament the following motion for a resolution, together with explanatory statement:

MOTION FOR A RESOLUTION

on the prevention of disasters during the extraction of oil and gas in north-west European waters

The European Parliament,

- having regard to the motion for a resolution on the prevention of disasters during the extraction of oil and gas in north-west European waters (Doc. 1-309/79),

- whereas in recent years socio-economic and political circumstances have led to a sharp increase in exploration for new off-shore oil and gas fields in generally difficult drilling areas, including the North Sea, this being of considerable importance to a number of Member States of the European Community,

- whereas the risks involved in the off-shore extraction of oil and gas in the North Sea are greater than is apparent from the statistics available inasmuch as:

  - the oil- and gas-bearing zones are situated at considerable depths below the surface;

  - the pressure in the underground strata is frequently high;

  - the geology of the sea-bed is complex; and

  - meteorological conditions in the areas in question are extremely erratic;

  and whereas the situation is such that new and advanced techniques which are virtually untried elsewhere are regularly being introduced,

- whereas an oil spill in the North Sea on the scale of that involving the drilling rig Ixtoc-1 in the Gulf of Mexico (1979) could have catastrophic consequences for the off-shore industry, the environment and the fishing and tourist industries, especially in the highly vulnerable tidal flats area which extends for 3,000 km along the Danish, Dutch and German coasts,

- whereas existing private, national and international arrangements for preventing and dealing with oil pollution in the North Sea abound with partial solutions, duplications and uncoordinated provisions and there is therefore no guarantee that swift and effective countermeasures could be taken if a large-scale disaster actually occurred,

- having regard to the report of the Committee on the Environment, Public Health and Consumer Protection (Doc. 1-473/80),

1. Calls on the Commission to obtain information on the causes, circumstances and effects of recent accidents involving off-shore installations;

2. Calls on the Commission to investigate existing national legislation on the living and working conditions of the workforce on off-shore installations, both as regards the safety of those concerned and with a view to preventing disasters which might be caused by human error;

3. Calls on the Commission to obtain information on the national legislation of the various North Sea coastal states on the off-shore extraction of oil and gas in their own territorial waters, and into the criteria applied by those states when issuing licences to various oil and gas companies for exploration for and the production of oil and gas, with particular reference to drilling rigs and safety regulations for drilling rigs;

4. Calls on the Commission to obtain information on the national legislation and provisions of the Member States and coastal states for dealing with large-scale marine and coastal pollution by oil, with particular reference to the availability of mechanical, chemical and biological facilities for combating pollution, to the coordination of the activities concerned and to the question of specific contingency plans for highly vulnerable coastal areas;

5. Calls on the Commission to obtain information on the activities and responsibilities of off-shore operators and oil and gas companies in the matter of direct measures to counteract the effects of disasters, with particular reference to the facilities available and the system of coordination;

6. Recommends the Commission in this connection to take steps to investigate the feasibility and usefulness of a special international coordinating body to provide coherent and responsible management of the North Sea and its resources and so to create suitable conditions for the protection of the environment in and around the North Sea;

7. Invites the Commission to submit a report on these matters to the European Parliament within the next year and at the same time to investigate the extent to which the European Community could help to coordinate the preventive and corrective measures taken by the Member States and any other countries involved (notably Norway) in dealing with large-scale oil pollution in the North Sea;

8. Invites the Council to provide the Commission with sufficient funds to enable it to comply with these recommendations;

9. Instructs its President to forward this resolution to the Council and Commission of the European Communities.

B

EXPLANATORY STATEMENT

1. Introduction

1.1 This report has been drawn up in connection with the motion for a resolution tabled by Mr MUNTINGH on the prevention of disasters during the extraction of oil and gas in north-west European waters (Doc. 1-309/79, 19 September 1979) in which the author refers to the accident involving the drilling rig Ixtoc-1 in the Gulf of Mexico.

1.2 This accident occurred on 3 June 1979 when the oil well which had been drilled under the sea-bed blew out. In the first few weeks after the disaster, the unusually high pressure in the reservoir caused a daily spillage into the sea of 4,000 tonnes of oil. In addition, the blowout was so complicated, with oil gushing from a number of fissures, that it took months to cap the well. It was not finally brought under control until March this year.

1.3 Although some of the oil ignited as a result of the explosions which occurred at the time of the blowout, nearly 400,000 tonnes poured into the sea, giving this gusher the all-time record for marine oil pollution, which had previously stood at 230,000 tonnes (the Amoco Cadiz disaster in March 1978).

1.4 The effects of this catastrophe on the environment were particularly serious. Large areas of the mangrove salt marshes in Yucatan and large areas of the Texas coast were polluted by oil. It may be decades before the ecosystem on these coasts is restored. The effects on the ecosystem in the open sea and on the sea-bed are also serious. Research on this aspect has now begun.

2. Sources of marine pollution by oil

2.1 There are no accurate statistics on the amount of oil discharged into the sea from various sources. However, recent estimates put the figure at between 5½ and 6½ million tonnes per year (North Sea Directorate, Rijkswaterstaat, Netherlands, 1978), and it is clear that the annual increase in marine oil pollution is keeping pace with the increase in world oil consumption.

2.2 Although off-shore blowouts such as that involving the drilling rig Ixtoc-1 and tanker accidents such as the recent wreck of the Amoco Cadiz attract a great deal of publicity, and although the immediate damage resulting from such incidents may be very great, disasters of this kind account only for a comparatively small percentage of the total amount of oil discharges into the sea.

2.3 The cources of oil pollution can be broken down as follows (Rijkswaterstaat, North Sea Directorate, Netherlands, 1972-1978):

Source	Percentage	Tonnage
The land	43%	2,550,000 tonnes
Shipping	35%	2,000,000 tonnes
The atmosphere	10%	600,000 tonnes
Natural seepage	10%	600,000 tonnes
Off-shore drilling	2%	100,000 tonnes

It should be pointed out in this connection that as a result of the Ixtoc-1 blowout the figures for oil pollution due to off-shore drilling will be much higher than 2% in 1979-1980.

2.3.1 Oil pollution from the land

(a) Most marine pollution by oil derives from land sources (43%). The oil is discharged into the sea principally through drains and rivers. It is estimated, for example, that 70,000 tonnes of oil flow into the North Sea from the Rhine. The most obvious sources are oil refineries, petrochemical plants and harbour silt. Most of these discharges are carefully monitored and are subject to national controls.

(b) In addition, a great deal of oil, much of it heavily polluted (for example, used engine or lubricating oil) is illicitly discharged in small quantities via drains and surface water. This polluted oil is frequently very toxic since it contains a high concentration of metals. At present, little is known about the effects of this long-term and frequently very toxic pollution of the marine environment by oil.

2.3.2 Oil pollution caused by shipping

Shipping, and in particular the increasing carriage of oil and petroleum products by sea, represent the second largest source of marine oil pollution (35%). Such pollution may be caused either deliberately, by operational discharges (about 72%), or unintentionally following an accident at sea (about 28%).

(a) Deliberate operational discharges are responsible for most of the pollution in this category. Tankers account for a good 80%, principally by discharging ballast water containing oil residues and discharging oil when cleaning tanks. In 1978 an amendment to the 1969 OILPOL Treaty laid down stringent conditions for the operational discharge of oil by tankers. As a result, an increasing number of modern tankers are equipped with systems which limit the operational discharge of oil. On the other hand, many small older vessels are still regularly resorting to the old practices.

(b) Unintentional spills from tanker accidents usually make the headlines when a supertanker is involved. The best known examples of this are the wreck of the Torrey Canyon (1967, off the coast of Cornwall, United Kingdom), when 117,000 tonnes of oil were spilled, the Urquiola disaster (1976, off Cape Finisterre, Spain), when 100,000 tonnes were spilled and the recent disaster involving the Amoco Cadiz (1978, Brittany, France) when 230,000 tonnes were spilled. The American Office of Technology Assessment claims, however, that between 1969 and 1975 there were more than 500 minor tanker accidents which resulted in more than one million tonnes of oil being spilled into the sea. It is striking that the frequency of accidents has increased in recent years and that older vessels are most at risk.

The Torrey Canyon and the Amoco Cadiz disasters have alerted people in Europe to the serious consequences of such large tanker accidents. On the other hand, there is much less information on the effects of regular operational discharges and minor tanker accidents.

2.3.3 Oil pollution from the atmosphere

The exhaust fumes from motor vehicles and waste gases from power stations, etc., contain hydrocarbon compounds which find their way into the marine environment by direct precipitation and soot fall-out. Experts estimate that this accounts for some 10% of oil pollution.

2.3.4 Oil pollution caused by natural seepage

Natural phenomena can bring crude oil to the surface on land and on the sea-bed. In some areas this happens on a fairly large scale. It is known, for example, that oil regularly seeps upwards from underground deposits into the sea in the Middle East, Indonesia, Venezuela, California and Alaska. It is estimated that such natural seepage accounts for some 10% of total marine pollution by oil.

2.3.5 Oil pollution caused by off-shore drilling

(a) Over a number of years the proportion of marine oil pollution caused by off-shore drilling was very low (2% on average) compared with the other factors mentioned above. Such pollution stems mainly from small but persistent discharges occurring in connection with exploration for and the production of off-shore oil. Although the risks of a disaster occurring during the extraction of oil at sea are generally not considered to be great a number of major accidents have occurred so far, the most serious being the incident in the Gulf of Mexico.

(b) In 1968 an accident occurred at the oil well in the Bay of Santa Barbara, California, USA. Although initially the well was successfully capped, oil and gas subsequently escaped through the porous sea-bed around the well because of the underlying high pressure. It took more than a year before the oil leak was finally sealed. During that time some 15,000 tonnes of oil seeped into the sea.

(c) In 1977 an accident occurred in the northern sector of the North Sea on the Bravo oil rig in the Ekofisk oil field. As a result of this accident oil began gushing from the platform above water, and although it was brought under control in a relatively short period, one week, 20,000 tonnes of oil were spilled into the sea.

(d) More recently, in 1979, a disaster occurred in the Gulf of Mexico involving the drilling rig Ixtoc-1 when 400,000 tonnes of oil were spilled into the sea.

3. Scale of off-shore oil extraction

3.1 The off-shore extraction of oil and gas began much later than on-shore extraction. Off-shore drilling for oil began in 1947 in the Gulf of Mexico, off the coast of Louisiana at a depth of 6 metres; this was the first off-shore extraction of oil in this area. In the 1950s off-shore extraction began in the Persian Gulf, off the coast of Alaska and around the islands of the Indonesian archipelago. In the 1960s, drilling for oil under the sea-bed began off the coast of West Africa (Nigeria, Gabon and Angola), off the east coast of Australia and in the North Sea.

3.2 Since then, a start has been made on the extraction of oil around the Canadian islands in the Arctic, off the east coast of North America, in the Gulf of Bombay, in the South China Sea, off the coasts of Thailand, Vietnam and Malaysia, off the north-west coast of Australia, off the coast of New Zealand and in the coastal areas of the East China Sea around the island of Sachalin.

3.3 In 1978, the Esso Company calculated that some 18% of annual world oil production, i.e. a good 550 million tonnes, was being extracted from off-shore wells. In 1978 there were some 1,250 drilling platforms in operation throughout the world. Esso estimates that there are oil deposits under one-fifth of the world's oceans with total reserves amounting to 90,000 million tonnes.

3.4 Thirty years ago, a start was made on extracting oil at a depth of six metres, but now it is extracted from the sea-bed at a depth of more than 1,000 metres. In 1978 the record was held by the drillship 'Discover Seven Seas' which struck oil at a depth of 1,325 metres off the West African coast at the mouth of the River Congo.

3.5 It is assumed that the off-shore extraction of oil will increase in the future. The OPEC countries (Organization of Petroleum Exporting Countries, set up in 1960) are still the main suppliers of the world's oil (accounting for almost 50%). However, since 1973, when OPEC sharply increased its prices, and since certain OPEC countries began using oil as a means of exerting political pressure, the industrialized nations and the developing countries have stepped up their search for undiscovered oil deposits.

3.6 Consequently, areas which previously were overlooked in the search for oil and gas because of the adverse conditions, such as Alaska and Siberia (very cold climate) and the North Sea (very unstable meteorological conditions), are now being thoroughly investigated. However, the risk of accidents is also increasing, and the potentially enormous scale of disasters in the off-shore oil industry has now become apparent.

4. Oil and gas extraction in North Sea

4.1 Size of oil and gas deposits

4.1.1 In 1965 the first gas field was discovered in the southern North Sea. In 1969 Philips announced that it had discovered the first oil field in the northern North Sea. Early estimates of the amount of oil and gas in the North Sea fields were modest. In 1972 Shell estimated that the oil deposits would amount to about 2,000 million tonnes. In 1975, it upped its estimates to 4,500,000,000 tonnes and in 1978, it stated that between 5,500,000,000 and 6,500,000,000 tonnes of oil lay under the North Sea. Since then, the gas deposits under the North Sea have been estimated at approximately four billion m^3.

4.1.2 Oil and gas deposits in the North Sea now probably amount to 5% and 4% of world oil and gas deposits respectively. Most of the oil and gas deposits lie under the British and Norwegian sectors of the North Sea. The Dutch sector contains mainly gas. A few small oil deposits have also been tapped in the Dutch and Finnish sectors, but so far, West Germany and Belgium have had little success.

4.1.3 Provisional reserves can be broken down as follows:

	oil	gas
Belgium	---	---
Federal Republic of Germany	---	---
Denmark	---	---
United Kingdom	3,000 million tonnes	2 billion m^3
Netherlands	---	350,000 million m^3
Norway	2,000 million tonnes	1.65 billion m^3

4.1.4 Although the available resources are modest in comparison with world supplies, oil and gas reserves in the North Sea are very important for a number of countries. Norway has become self-sufficient in oil and gas and now exports a considerable amount of its production. The Netherlands is now self-sufficient in gas (from its gas deposits in Slochteren) and is also a net exporter. The United Kingdom now meets almost 70% of its own oil and gas requirements and hopes to increase its production sharply in the 1980s.

4.1.5 It should be noted that at the current level of production, supplies will be exhausted in the next 25-40 years. Norway, and to a lesser extent the Netherlands, are therefore pursuing a policy of cutting back on production, whereas the United Kingdom prefers to develop and exploit its oil and gas fields in the North Sea rapidly. (For a map of the oil and gas fields see Fig. I).

4.1.6 When a start was made on exploring for and extracting oil and gas in the North Sea, it was possible to make use of the experience acquired in the 1950s and 1960s in other areas (see point 3). Nonetheless, a number of specific problems arose in the North Sea: the weather there is often bad and very changeable, winds of up to 240 km/h are frequent with waves 30 metres high. As a result, a number of new techniques had to be developed for the exploration and exploitation of these fields.

4.2 Drilling techniques

4.2.1 The same drilling techniques are used for on-shore and off-shore exploration or production operations. Before work begins on the actual well, a derrick is erected and made fast to the ground or sea-bed. A riser connecting the wellhead to the platform (or drillship) is then installed and a bit, driven by a series of linked drill pipes from the platform (or drillship), is lowered through it. As drilling continues, further pipes some 9 metres long are added. In this way a hole some 60 metres deep is bored with a large diameter bit. A broad pipe, the well casing, is lowered into this hole and cemented into position. A smaller diameter bit is then used to drill down to 120 metres and a slightly narrower well casing is lowered through the hole and fixed into position. This process is repeated until the oil or gas deposit is reached. The final casing resembles a telescope (see Fig. II).

4.2.2 Drilling mud is pumped continuously down the drill pipe. This mud has two important functions: it carries to the surface any crushed rock between the wall of the borehole and the outer wall of the drill pipe, and it maintains a balance between the pressure in the well and the pressure in the underground rock formations. The relative density of the mud must be continually adjusted to meet the constantly varying requirements arising from the changes in the rock formations through which the bit is cutting. Such adjustments are made by adding solid substances to the mud, which must, however, remain fluid.

4.2.3 The danger point comes when gas or oil is struck, at which time the pressure in the borehole can suddenly become very high. For this reason, a blowout preventer is fixed to the wellhead as a safety measure. The function of such preventers is to protect the well against blowouts if the drilling mud fails to do so. The blowout preventer consists of a series of valves which can be closed hydraulically from the platform or drillship. This occurs automatically should the pressure in the borehole suddenly increase. Once these valves are closed, the mud in the borehole can be replaced by a heavier mud through other valves and in this way the well can once again be brought under control. The blowout preventer may be located on the sea-bed or on the platform. In the case of drillships or semi-submersible rigs it is usually on the sea-bed; in the case of fixed platforms, it is generally on the platform.

4.3 Exploratory wells

4.3.1 The way in which exploratory wells are drilled depends largely on the depth of water at the drilling site.

4.3.2 In water up to a depth of some 90 metres jack-up platforms are used. These have legs which can be lowered to the sea-bed and retracted when drilling is completed so that they can be towed to another site. Such platforms can only be used if the sea-bed is firm enough to support the weight of the legs. Their major advantage is that once in place they can be used for drilling operations even in unfavourable weather conditions.

In the northern North Sea, where the water is more than 90 metres deep, semi-submersible rigs are used for drilling in depths of up to 600 metres. These rigs, which are much larger than jack-up platforms, are supported by pontoons or buoyancy columns situated between 10 and 15 metres below the surface of the water. They are reasonably stable and work stops only when the weather conditions become very bad.

In deeper waters, up to a depth of 1,500 metres, drillships can also be used. Such vessels are, however, very vulnerable in bad weather and this is a disadvantage given the conditions prevailing in the North Sea.

4.3.3 Semi-submersible rigs and drillships are kept on station by means of anchors in the sea-bed or by dynamic positioning, i.e. a system of computer-controlled thrusters which respond automatically to any changes in wind, currents and waves and maintain the rig or ship in a constant position.

4.3.4 Unlike jack-up platforms, semi-submersible rigs and drillships move, and this calls for a special coupling between the wellhead and the rig or ship. This coupling, called a riser, is kept under tension by means of a swell stabilizer to prevent buckling or fracturing.

4.3.5 Swell stabilizers are hydraulic support systems fitted to the rig which help to compensate for vertical movement. Horizontal movement is compensated for by a flexible universal joint at the bottom of the riser.

In 1978, 9 jack-up platforms, 30 semi-submersible rigs and 4 drillships were being used for exploration in the North Sea.

4.4 Production wells

4.4.1 After a strike at an exploratory well, the extraction phase begins. In order to maintain optimum production levels even during bad weather, maximum use is made of steel platforms. These platforms are anchored by their legs to the sea-bed, for which purposes massive piles are driven some 100 metres into the sea-bed. If the sea-bed is too hard, holes are bored into which piles are lowered and cemented fast. Such steel platforms are a good 180 metres high and can be used in depths of up to 160 metres[1].

4.4.2 Some years ago, work began in Norway on the construction of concrete platforms. These platforms do not need piles; nor do they have to be anchored. They can withstand the wind, waves and currents because of their enormous weight. Since such platforms have a very broad base, large amounts of oil can be stored on them. However, they can only be used in areas where the sea-bed is hard and level. In addition, they are very difficult to move.

4.4.3 When oil is extracted at deepwater sites, subsea completion techniques are also used. In such cases the well and the equipment, including the blowout preventer, are located wherever possible on the sea-bed and covered with a dome. Pipes lead from the well to a gathering station which is also set up on the sea-bed. From the gathering station the oil is pumped either to a floating rig through a marine riser or directly to the mainland through secondary pipelines.

4.4.4 Since production platforms are very costly, an effort is made to connect as many wells as possible to one platform or as many subsea installations as possible to one gathering station. In the North Sea some platforms and gathering stations are connected to more than 10 wellheads.

4.4.5 Early in 1979 there were 104 production platforms in the North Sea, one of which was made of concrete (the Statfjord-B platform); in addition, there were some 25 subsea installations. It is likely that by mid-1983 there will be some 170 production units in operation in the North Sea, 70 extracting oil and 100 gas.

4.5 Transport and pipelines

4.5.1 There are two methods of transporting oil from the oilfield to the coast: by tanker or by pipeline. Transport by tanker usually follows the traditional pattern: the oil collected in gathering stations on the sea-bed or on or near a production platform is pumped into tankers which then transport it to the mainland. As yet, no gas is transported by tanker, but there are plans to liquefy it off-shore and then transport it by tanker.

4.5.2 Pipelines are principally used for transporting gas to the mainland but in some cases they are also used for oil. At present there are some 2,000 kilometres of pipeline under the North Sea (see Fig. I). The largest pipes are 90 cm in diameter, the smaller ones 60 cm. Since pipelines are very vulnerable, it is preferable to coat them in concrete, bury them in the sea-bed and regularly monitor them for damage or corrosion. This work is carried out by divers or by pumping a cylinder or sphere carrying instruments through the pipeline. At regular intervals, safety valves are fitted to the pipelines which close automatically should any leakage result from damage to the pipeline.

5. Disasters

5.1 Some 2% of total marine oil pollution results from drilling (see point 2). This pollution is caused by accidents during exploration and production. The causes of accidents are generally broken down as follows:

North Sea Directorate, Rijkswaterstaat, Netherlands, 1978	
- fires on platforms or drillships	4%
- fractures in pipelines	30%
- overspill (leaks when cleaning tanks or during transport)	50%
- blowouts	4%
- miscellaneous	8%

5.2 As the above table shows, blowouts officially account for only a small percentage of drilling accidents. However, it is doubtful whether this figure can be applied at face value to the situation in the North Sea. When a blowout occurs the well generally goes out of control. The blowout preventer, which is designed to compensate for varying extremes of pressure, can fail inter alia if it is suddenly exposed to very high pressure. When this happens, gas and oil are expelled from the borehole, the force of expulsion depending on the pressure involved.

5.3 A blowout which leaves the well, the shaft and the casing intact, is known as a one-hole blowout. If the blowout preventer is located at the top of the shaft, i.e. on the platform, the oil gushes out from above the surface of the water. In most cases this is accompanied by an explosion and fire. The blowout which occurred on the Bravo platform in 1977 was of this type. There is a danger that the fire and explosion will cripple the platform and thus submerge the blowout. Experience has shown that underwater blowouts are very difficult to control, so the fire must be extinguished as rapidly as possible to prevent destruction of the platform. An attempt must then be made to control the gusher. The blowout on the Bravo platform was brought under control relatively quickly (one week).

5.4 If drilling operations are being carried out from a semi-submersible rig, a drillship or a subsea installation, the blowout preventer will be located on the sea-bed at the wellhead. A blowout in a well of this nature is much more serious and much more difficult to control. Frequently the wall of the borehole is damaged and oil and gas rise to the surface outside the shaft casing. If the sea-bed is soft or porous, oil and gas escape from several fissures and the situation becomes difficult to contain (cratered blowouts). The accident which occurred in 1967 in the Bay of Santa Barbara, California, and the recent accident with Ixtoc-1 in the Gulf of Mexico were of this type. It took more than a year to cap the well off Santa Barbara, and almost a year to bring the well in the Gulf of Mexico under control. The average time required to bring a cratered blowout under control is estimated at 120 to 150 days.

5.5 No one can accurately estimate the likelihood of a blowout in the North Sea. The oil companies do all they can to prevent blowouts, if only for economic reasons. Current practice shows no evidence of lack of care or recklessness. But that does not mean that a disaster on the scale of the recent accident in the Gulf of Mexico is inconceivable. Conditions in the North Sea are more difficult than they are in the average off-shore field: the water is deeper, the weather is frequently bad, the oil- and gas-bearing formations are located at great depths, the pressure in the underground reservoirs is often high, and the geology of the sea-bed is complex. It is reasonable to suppose that in these circumstances the chances of a blowout in the North Sea are greater than would appear from available statistics.

6. The behaviour of oil in the sea and on the shore

6.1 Oil in the sea

6.1.1 When oil first comes into contact with water it spreads out, mostly over the surface. Thin oil slicks are a silvery colour, thicker slicks (1½ to 10 mm) are dark brown or black. As a slick spreads, the more volatile compounds evaporate. Once the lighter substances have evaporated, heavy oil may sink to the sea-bed or remain suspended in the water. This may occur rapidly, particularly in cold waters. If the water temperature rises, the oil which had sunk can rise to the surface again and thus create new problems several months after the original spill. Evaporation plays an important part in reducing the total volume of oil in the sea. When North Sea oil, which is fairly light, is discharged into the sea, after one day some 33% of the total volume will have evaporated and after five days about 53%. The oil produced in the Gulf of Mexico and the Caribbean is much heavier. If discharged into the sea, about 11% will have evaporated after one day and about 23% after five days.

6.1.2 However, such evaporation only partly solves the pollution problem. After the Torrey Canyon ran aground, (discharging 60,000 tonnes of oil into the sea) the volume of hydrocarbons that evaporated rose very quickly to the level annually discharged into the atmosphere in England from other sources. This gave rise to serious air pollution in addition to coastal and marine pollution. Oil contains a number of substances which not only evaporate but also dissolve in water. Although the process if a lengthy one some 10% of the oil can still disappear in this way. A small amount is also lost through oxidation and through bacterial action which breaks down the oil naturally. Very little is known at present about the last two phenomena.

6.1.3 These processes occur when oil behaves normally, i.e. when the oil emulsifies in the upper water layer. When the Torrey Canyon ran aground the oil emulsified in the water in the form of a brown, foaming, gelatinous mass. This emulsion consisting of 70-80% water, was surprisingly stable, spread very little, evaporated slowly and scarcely dissolved at all. Such oil slicks are called 'chocolate mousse' because of their appearance. The movement of an oil slick in seawater is determined by the wind, current and the thickness of the slick.

6.2 Oil on the shore

6.2.1 If the oil reaches the shore, its behaviour will depend on the nature of the oil slick and the type of coast involved. Oil which has been exposed to the elements and the sea for a fairly lengthy period and residues of heavy fuel oil form tar balls on the shore. Such tar balls are easy to remove. Thin oil causes more problems because it collects in tide pools and permeates into the sand or gravel layers. As a result low tide can sometimes bring sudden pollution to large areas of beach. If oil is washed ashore in the form of 'chocolate mousse', it not only causes serious shore pollution, but can also be blown inland by the wind and cause great damage there as well.

6.2.2 Complex coastal systems, where there is no clear distinction between sea and land, such as salt marshes and mud flats, are very vulnerable to pollution because the oil is spread over a large area. Rocky coasts, gravel and shingle beaches are also vulnerable and very difficult to clean up. In the case of rocky coastlines, the oil gradually weather on the rocks but the heat of the sun can liquefy it again and cause further problems.

Oil washed up on to sandy beaches is fairly rapidly covered by sand. If necessary large amounts of oil can be removed with bulldozers.

It is difficult to estimate the potential consequences of a large-scale disaster in the North Sea. The coasts of Great Britain, the Scottish islands and Norway are largely rocky and therefore vulnerable and difficult to clean up. The tidal flats off the coasts of Denmark, Germany and the Netherlands constitute one of the largest natural habitats in Europe, extending over more than 3,000 kilometres. A large-scale oil spill in this vulnerable coastal zone would have disastrous consequences for the future of the area and its unique ecological system.

7. Biological effects of oil pollution

7.1 The fact that oil exists in various forms is a crucial factor in the biological effects of oil pollution. The kind of oil, the extent of weathering, the time and place of the spill, the depth of the water and, in the case of oil washed ashore, the type of coastline, are all factors in the equation. The biological effects of oil in the sea are generally classified as follows:

- direct fatal toxicity,
- sublethal effects on physiology and behaviour,
- absorption and accumulation of the substances contained in oil,
- changes in habitat.

7.2 Many organisms die from the effect of the poisonous substances contained in oil. Fresh oil, in particular, where no evaporation has taken place, causes death by poisoning. Although the susceptibility of different organisms varies widely, it is accepted that a good half of all organisms do not survive direct contact with fresh oil.

7.3 The sublethal effects, i.e. effects which do not result in death within a few weeks, have not yet been studied in depth. It has been demonstrated that the ingestion of food, metabolism, growth, reproduction and so on have been adversely affected in a number of marine species by regular contact with oil in the marine environment. Changes in fish behaviour have been demonstrated, particularly as a result of damage to sensory organs.

7.4 Seabirds and smaller organisms in the coastal zones suffer from being covered with oil. Birds are particularly vulnerable. Experts estimate that 150-450,000 birds are killed each year in the North Sea and the northern Atlantic Ocean. Most are victims of oil discharge from ships or spills from tanker accidents. The Torrey Canyon shipwreck caused the deaths of some 80,000 seabirds, in particular guillemots and razorbills. After the recent Amoco Cadiz disaster, some 20,000 birds died, mainly razorbills and puffins.

7.5 The absorption and bio-accumulation of certain oil components can be fatal to certain organisms in the long term. When accumulation occurs in the food chain, slow poisoning processes may begin which gradually work through the whole chain. Among others, the seals living on the tidal flats mentioned above fall victim to this phenomenon.

7.6 Changes in habitat resulting from oil pollution can have such drastic effects that for a number of organisms recolonization remains impossible for years.

In open coastal areas, on rocky, sandy and gravel coasts, the ecosystem recovers fairly rapidly. Most of the biological effects are eliminated in about three years. The situation is much worse in the case of complex coastal systems. A large-scale oil disaster in the tidal flats area could dislocate the ecosystem of the region for more than 15 years.

8. Effects on fishing

If oil reaches the coastline, following a large-scale disaster, considerable damage is done to the inshore fishing and the oyster and mussel farming industries. In addition, catches can diminish because fish are killed and the industry can suffer over a long period because the taste of the fish is spoiled. Deep-sea fishing can also be adversely affected over a lengthy period because spawning grounds in the coastal waters are affected by the oil. These spawning grounds are mainly located in the Danish, Dutch and German tidal flats.

9. Effects on recreation

Pollution of coastal areas by large amounts of oil can have particularly serious consequences for the tourist industry. In the high season the coasts of Holland and the Frisian Islands are visited by an estimated 750,000 tourists per day. If large-scale oil pollution were to affect one-quarter of the coast, the resulting loss for the Netherlands would amount to 4 million guilders per day.

In addition to these short-term losses, large-scale or long-term pollution of the beaches could cause lasting damage because holidaymakers, especially from abroad, would avoid the area for several years.

10. Dealing with oil spills

10.1 When large amounts of oil are spilled into the sea following an accident involving a drilling rig or a tanker, the first priority is to prevent the oil from spreading, and from reaching the biologically vulnerable areas. A number of methods have been developed to deal with oil pollution at sea.

10.2 If the oil is floating on the surface and has not spread too far, it is preferable to remove it by mechanical means. To do this requires one or more anti-pollution vessels equipped with mechanical removal systems and storage tanks. Mechanical removal is only possible if the anti-pollution vessel can rapidly reach the location of the slick.

10.3 If the oil has spread too far the dispersal method can be used. In such cases sprayer aircraft or ships with mobile spray equipment apply detergents to the oil slick to disperse it. This considerably speeds up the process of biodegradation. This method can only be used in deep waters, well away from coasts because the detergents pollute the environment.

10.4 If the volume of oil involved is so large that the two methods mentioned above are inadequate and the oil poses an unacceptable threat to the coastal regions, the oil-sink method can be used. In this case a mixture of sand and water is sprayed on to the oil slick. The oil is absorbed by the sand and sinks to the bottom because of the increase in relative density. One major disadvantage of this method is that the oil treated in this way can cause great damage to the fauna on the sea-bed and to the fishing industry.

10.5 Finally, attempts can be made to burn off the oil at sea. For this, the oil slick must be fresh and at least a few millimetres thick. In addition, the oil must not be near a coast, a rig or a shipping route. It is possible to clear up a large volume of oil in this way (50,000 - 80,000 m^3) within a few days.

10.6 Vacuum trucks, bulldozers, dumper trucks, excavators, tipper trucks and trailers can be used to remove oil from beaches, especially when fairly large amounts are involved. Such heavy plant is particularly suitable for sand and pebble beaches. In the case of more complex coastal regions, cleaning up is much more difficult. It is preferable then to employ a large workforce and lightweight equipment.

11. Anti-pollution facilities available in the North Sea coastal states

11.1 In June 1969, after the Torrey Canyon disaster, representatives of the North Sea coastal states, meeting in Bonn, signed an Agreement for cooperation in dealing with pollution of the North Sea by oil. As a result of this agreement, an initial list of the facilities available in the signatory States for dealing with oil pollution was drawn up early in 1979. In general, the countries involved prefer to use mechanical equipment. The Scandinavian countries and the Netherlands have developed various systems and have acquired the necessary experience. The other countries are also working on mechanical systems but at present they use only chemical methods.

11.2 The following brief summary describes the anti-pollution facilities available in the various countries concerned.

The United Kingdom still has no operational mechanical systems, detergents being used to combat oil pollution. According to latest figures, three ships are equipped for this purpose with anti-pollution equipment including spray arms and pillow tanks. When an accident occurs, available ships are hired and equipped with anti-pollution equipment and tanks containing detergent. This equipment is stored at a number of British ports. In all, 95 spray arms and about 250 tanks are available.

The Netherlands has facilities for dealing with oil pollution by mechanical and chemical means. The Government owns five anti-pollution vessels and can call on another two private ships equipped with anti-pollution equipment. One of the anti-pollution ships, the 'Smal Agt', is specially equipped to carry mechanical equipment. All the ships are also equipped with spray arms and detergent tanks. Sprayer aircraft can also be used to deal with oil pollution. In addition, the Netherlands has drawn up a detailed contingency plan for the coastal regions.

Belgium has only chemical systems for dealing with pollution. Nine minesweepers specially equipped for this task are available.

Germany has various mechanical and chemical anti-pollution systems. For mechanical operations, ships are equipped with sweep arms, skimmers and storage tanks. Various ships equipped with spray arms can be used for chemical operations. Plentiful supplies of detergents are available.

Denmark has various sweep arms and removal systems which can be fitted to a number of ships at short notice. Six barges are available to collect oil. In addition, Denmark has another four vessels which can be used for chemical operations.

Norway also has equipment for dealing with oil pollution by mechanical and chemical means. Various sweep arms, removal systems and storage tanks are available. Four ships are also available to deal with oil pollution by chemical means.

12. Legal and administrative aspects

12.1 National provisions

12.1.1 Licences to explore for oil and gas in the North Sea and subsequently to produce it have been issued by the various Member States to some 20 companies. Before the governments agree to exploratory and production drilling, the companies' plans are assessed by national offices. This is done in Norway by Norske Veritas, in the United Kingdom by Lloyds, in the Federal Republic of Germany by German Lloyds and in the Netherlands by the Off-shore Certification Foundation of the Netherlands. Only when the installation is complete does the office issue a definite licence on the basis of which a start may be made on exploratory or production drilling. In the case of conversion or transfer, a new licence must be applied for.

12.1.2 If an accident has occurred, with a subsequent escape of oil or gas, the companies themselves must in the first instance do everything to prevent the effects from spreading. The oil and gas production companies and the off-shore operators in the United Kingdom, Norway, Denmark and the Netherlands have agreed to pool all their available resources in dealing with emergencies in oil and gas installations in the North Sea. To this end, the companies have divided the North Sea into six geographical sectors. A coordinator is appointed for each sector to coordinate assistance in an emergency. At the moment there are 15 firefighting ships in these six sectors, together with other equipment which can be called on in an emergency.

12.1.3 Although the national governments assume that in the event of an accident the companies involved bear primary responsibility, they also recognize their public responsibility. Consequently they make equipment available to deal with oil pollution along the coast (see point 11) and have set up administrative organizations to coordinate any offers of assistance:

In the United Kingdom the Marine Division of the Department of Trade is responsible for measures to deal with oil pollution in the British sector of the North Sea. A special Marine Division, the Marine Pollution Control

Unit, has been set up to deal with large-scale or complicated clearance operations.

In Norway it is also assumed that the off-shore industry bears primary responsibility. The government makes equipment available to deal with oil pollution along the coast (see point 11). The 'Lov om vern mot oljeskader', (the 1970 Act on measures to combat oil pollution) lays down that a report on the capacity and utilization of anti-pollution facilities must be submitted to the Norwegian Parliament every year.

In the Netherlands, the North Sea Directorate of the Rijkswaterstaat, a division of the Ministry of Transport and Waterways, is responsible for dealing with oil pollution in the North Sea. Although it is also assumed in the Netherlands that the companies involved are primarily responsible, a very detailed contingency plan has been drawn up for action should the coastline be threatened. The North Sea Directorate of the Rijkswaterstaat is responsible for coordination. Local authorities along the coast are called in should pollution threaten particular areas.

12.2 International legislation

12.2.1 There are a number of international conventions and regulations which directly or indirectly concern off-shore installations in the North Sea.

12.2.2 One of the earliest sets of rules is contained in the Agreement for cooperation in dealing with pollution of the North Sea by oil which was signed in Bonn on 9 June 1969. This Agreement was drawn up after the 'Torrey Canyon' ran aground off the British coast. Pursuant to this Agreement, in which the North Sea coastal states agreed to divide the North Sea into zones for dealing with pollution by oil, each country is responsible in its own zone for inspecting and dealing with oil slicks. Should the oil threaten another zone, the country which is responsible in the second zone must be informed. Mutual assistance must be given where necessary. This Agreement has now entered into force. Representatives of the signatory states meet at regular intervals to exchange information on the monitoring of pollution and the effectiveness of the methods and means of dealing with it.

12.2.3 In 1972 the Convention to prevent sea pollution by the dumping of waste from ships and aircraft was signed. This regional Convention was drawn up in Oslo and has now entered into force. The Convention prohibits amongst other things the dumping of waste and surplus material from ships, aircraft and drilling rigs. Coastal states must ensure that the companies operating drilling platforms leave no equipment behind on the sea-bed when they move the rig.

12.2.4 In 1973 the MARPOL Convention was drawn up in London under the auspices of IMCO. This Convention, which was amplified in 1978, is principally designed to prevent marine pollution by shipping. However, it also contains a provision which prohibits oil mixtures being discharged into the sea from drilling rigs. The Convention is international but has not yet entered into force.

12.2.5 In 1974 a regional Convention was drawn up in Paris on the prevention of sea pollution from the shore. This Convention prohibits the discharge of a number of substances (black list) and makes the discharge of a number of other substances (grey list) subject to authorization. Drilling rigs are also covered by this Convention which has not yet entered into force.

12.2.6 In 1977 the international secretariat responisble for implementing the Oslo and Paris Conventions began work. The secretariat will also offer its services for the implementation of the Bonn Agreement.

12.2.7 In 1977 the Convention on civil liability for oil pollution damage resulting from exploration for and exploitation of sea-bed mineral resouces was drawn up. This Convention, which concerns liability in the case of accidents to off-shore installations, has not yet entered into force.

12.2.8 In this context, reference should also be made to the Conference on safety and pollution safeguards in the development of north-west European off-shore mineral resources. This Conference held its first meeting in London in 1973 and its second in 1978 in the Hague. It hopes to meet again in autumn 1980. The Conference has set up working parties to undertake preparatory work and has turned its attention to ecological and oceanological matters, the construction and utilization of off-shore installations and the safety of the workforce in the off-shore industry. The London Civil Liability Convention is one of the results of this Conference. In 1980 the Conference will devote itself in particular to construction standards for mobile drilling rigs.

12.3 European measures

12.3.1 After the Bravo platform disaster and the Amoco Cadiz disaster (in 1977 and 1978 respectively), the European Community made an attempt to initiate Community measures to prevent or limit marine pollution by oil.

12.3.2 In June 1977, after the Bravo disaster, the Commission submitted a draft resolution to the Council on measures for the prevention, control and reduction of pollution caused by accidental discharges of hydrocarbons into the sea (COM(77) 265 final). The following measures were proposed in that draft resolution:

- the establishment of a data bank at Community level recording the means available for taking action in the event of accidental discharges of hydrocarbons;

- the development of a research programme into the technologies for collecting and dispersing hydrocarbons, into what happens to hydrocarbons in the sea and into their effects on marine fauna and flora;

- the appointment of a group of high-level experts to examine the causes, circumstances and effects of recent accidents involving considerable spills of hydrocarbons in the sea, the remedies and preventive measures; the group would also be responsible for studying preparations for an environmental impact report on installations for prospecting and drilling for hydrocarbons at sea;

- the effective implementation of international agreements on pollution by hydrocarbons from off-shore installations, in particular the Bonn Agreement of 9 June 1969 on cooperation in dealing with pollution of the North Sea by oil and the Protocol to the Barcelona Convention of 16 February 1976 concerning cooperation in combating pollution of the Mediterranean Sea by oil and other harmful substances.

12.3.3 On 10 May 1977 the Commission made a statement to the European Parliament explaining this action programme and proposing that an appropriate draft resolution should be submitted to the Council without waiting for Parliament's opinion, which is what in fact happened. However, the Council took no decision on the action programme or the attached resolution.

12.3.4 In 1978, after the Amoco Cadiz disaster, the Commission submitted a further draft resolution to the Council setting up an action programme of the European Communities on the control and reduction of pollution caused by hydrocarbons discharged at sea (OJ No. C 162, 8.7.1978 p. 1). In this resolution the following measures are proposed:

- computer processing of the existing data, or data still to be collected, on ways of dealing with marine pollution by hydrocarbons with a view to the immediate use of such data in the event of accidental pollution;

- study of the availability for the Member States of relevant data on tankers liable to pollute the waters around the Community and the coasts of the Member States and on off-shore structures under the jurisdiction of the Member States;

- study of the need for measures to enhance the cooperation and effectiveness of the emergency teams which have been or which are to be set up in the Member States;

- study of a possible Community contribution to the design and development of clean-up vessels to which may be fitted the equipment needed for the effective treatment of discharged hydrocarbons;

- study of the amendments and improvements which may have to be made to the legal rules on insurance against the risks of accidental pollution from hydrocarbons;

- establishment of a proposal for a research programme on chemical and mechanical means of combating pollution due to hydrocarbons discharged at sea, on the subsequent history of such hydrocarbons and on their effect on marine fauna and flora.

12.3.5 In June 1978 the European Parliament delivered a favourable opinion on this action programme and the Council then adopted the resolution proposed by the Commission. The Commission has since made a start on implementing the action programme. A number of studies are already in their final stages.

12.3.6 Finally: pursuant to a Council decision of June 1974 the Mines Safety and Health Commission of the ECSC was given special powers relating to the control of exploratory and production drilling in the sea-bed. This Commission has set up a special Working Party on Petroleum, Natural Gas and Other Minerals Extracted by Drilling, and this special working party has in turn set up an Expert Committee on Well Control.

12.3.7 In June 1978 the Expert Committee on Well Control submitted a detailed technical proposal to the governments of the Member States of the European Community on well-head safety installations at sea. It is not known how far these proposals, which are principally advisory, have been put into practice.

12.3.8 Although private, national and international (including European) regulations on the prevention and combating of marine pollution by oil give an impression of goodwill and good intentions, it should be noted, nonetheless, that there are so many partial solutions, overlapping regulations and uncoordinated measures that if a large-scale disaster actually occurred, there is no guarantee that its effects could be rapidly and effectively dealt with.

13. Conclusions

13.1 Considerations

13.1.1 Although off-shore blowouts similar to that involving the drilling rig Ixtoc-1 and tanker disasters such as that involving the Amoco Cadiz attract a great deal of attention and publicity, and although the short-term damage caused by such disasters is enormous, attention should be drawn first and foremost to the effects of long-term marine pollution by oil from the mainland, from shipping and from the atmosphere which is much more serious than the pollution caused specifically by the above accidents.

13.1.2 Nonetheless, reference is quite rightly made in Document 1-309/79 (PE 59.510) to the enormous risks involved in the off-shore extraction of oil and gas, especially in the North Sea.

- The conditions in the North Sea are much more difficult than those in the average off-shore extraction areas; the water is deeper, the oil and gas zones are at greater depths, the pressure in the underground reservoirs is frequently high and the geology of the sea-bed is complex.

- In the North Sea, new and advanced techniques are regularly being introduced to solve these problems, although little experience has been acquired with such techniques elsewhere.

- More than twenty competing companies are operating in the North Sea on licences issued by six North sea coastal states including five Member States of the European Community.

- The political and socio-economic conditions facing some governments are such that those governments are disposed towards developing off-shore oil and gas fields very rapidly.

All this makes it reasonable to suppose that the risks in the off-shore extraction of oil and gas in the North Sea are greater than might be apparent from the existing statistics.

13.1.3 A disaster on the scale of that involving Ixtoc-1 may have disastrous effects on the marine environment and the coastal regions because:

- the flora and fauna, even if they were not irrevocably destroyed, would take 10 to 15 years to recover;

- large-scale economic damage could be caused to the fishing and tourist industries in the areas involved.

13.1.4 In this context particular attention must be drawn to the very vulnerable tidal flats which extend for 3,000 km along the Danish, Dutch and German coasts.

13.2 Recommendations

13.2.1 The Commission is invited to obtain information on:

- the causes, circumstances and effects of recent accidents involving off-shore installations;

- the national legislation in force in the various North Sea coastal states and concerning the off-shore extraction of gas and oil in their territorial waters, making a comparative study of this legislation with a view to establishing whether there are noticeable differences or specific deficiencies;

- the criteria applied by the North Sea coastal states when issuing licences to the various oil and gas companies to prospect for and extract gas and oil in the North Sea, with special reference to drilling rigs and wellhead safety devices;

- the living and working conditions of the workforce on off-shore installations, since human error, including fatigue, can be a factor in accidents;

- the measures taken by oil and gas production companies and off-shore operators to deal directly with the consequences of accidents, with special reference to the facilities available and to the coordination system;

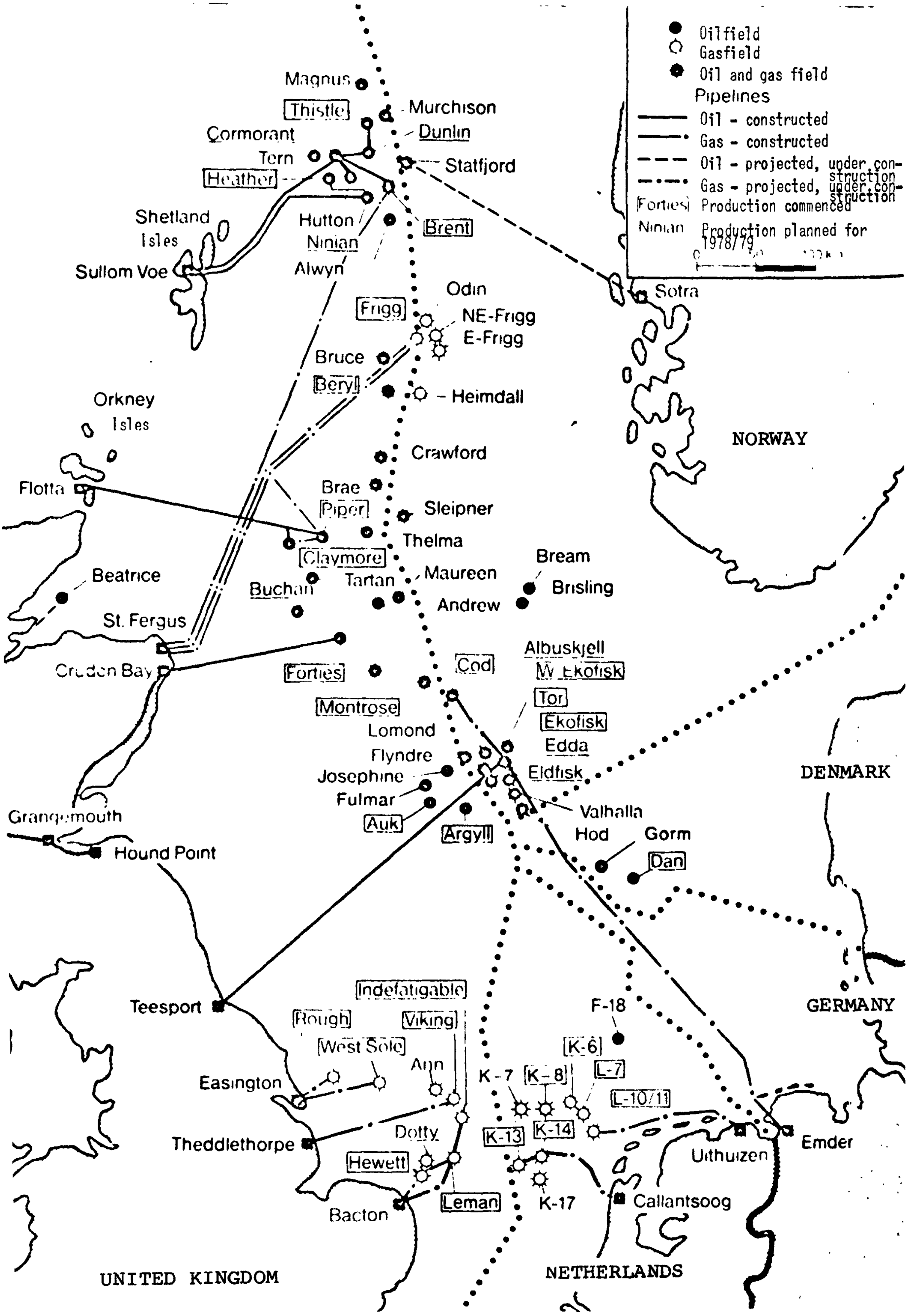
- national rules for dealing with extensive marine oil pollution, with special reference to the way in which the action taken and the methods used are coordinated with those used by the off-shore industry, to the availability of mechanical and other means for dealing with pollution, to the coordination of the steps taken and to the existence of specific contingency plans, in particular for very vulnerable coastlines;

- the legislation, rules and measures of the North Sea coastal states for dealing with the long-term pollution of the North Sea by oil.

13.2.2 The Commission is invited to submit a report on the above matters to Parliament within twelve months. Subsequently, an enquiry can be made into the extent to which the Commission is capable of playing a coordinating role in respect of the preventive and corrective measures taken by the Member States and other countries (especially Norway) to combat the pollution of the North Sea by oil. To this end, a special administrative body (North Sea Forum) and a special fund (North Sea Environmental Fund) should be set up.

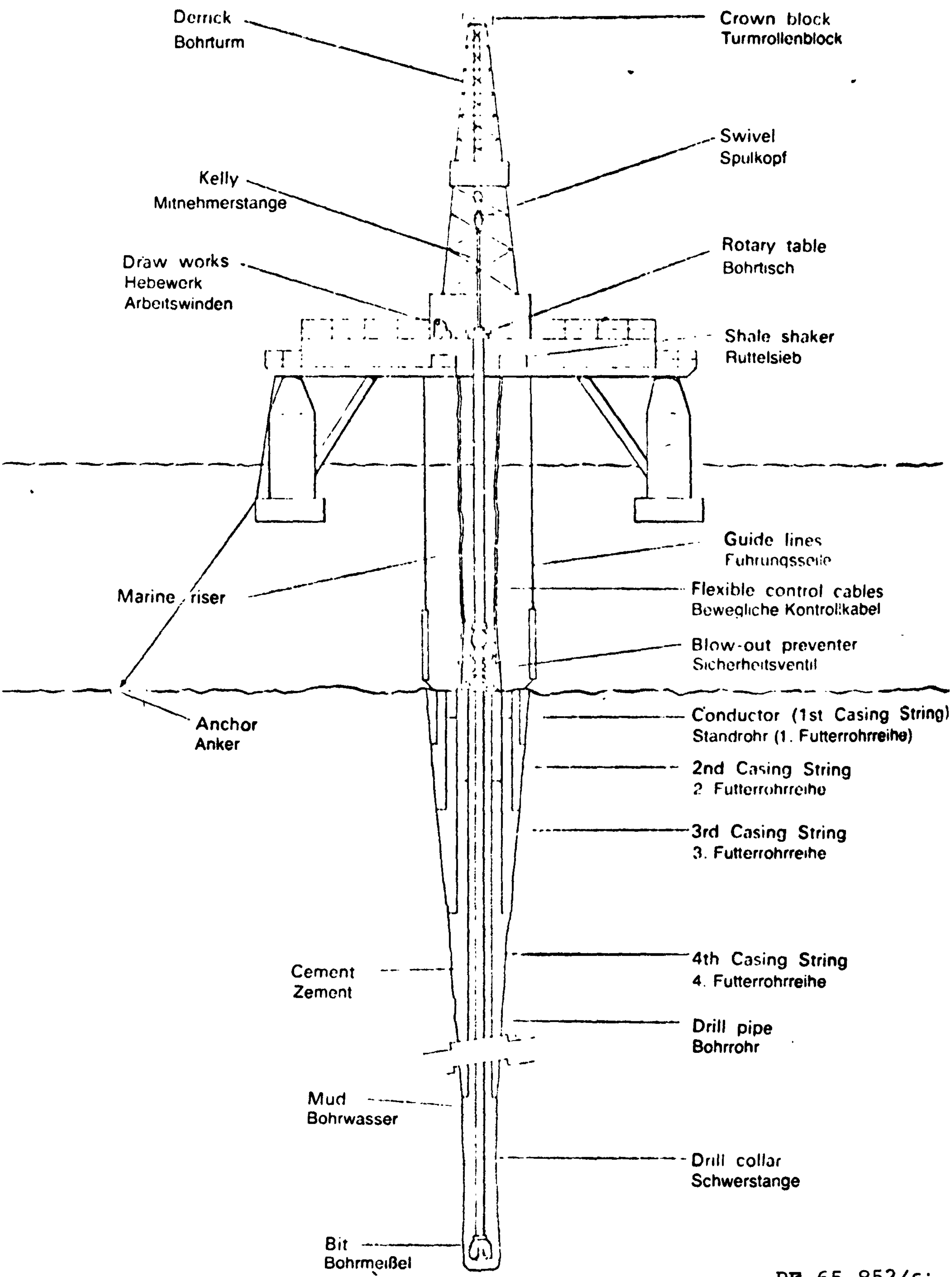
13.2.3 The Council is invited to provide the Commission with the necessary powers and funds to act in accordance with these recommendations.

PETROLEUM AND GAS FIELDS IN THE NORTH SEA



Beispiel einer Bohrinsel

DRILLING RIG



ANNEX III

MOTION FOR A RESOLUTION
tabled by Mr MUNTINGH
(Doc. 1-309/79)
pursuant to Rule 25 of the Rules of Procedure

on the prevention of disasters during the extraction of oil and gas in north-west European waters

The European Parliament,

- profoundly disturbed by the disaster involving the drilling rig IXTOC 1 in the southern part of the Gulf of Mexico and by the damage to the natural environment caused by this disaster,

1. Requests the Commission to encourage all possible measures to prevent such disasters occurring in north-west European waters;

2. Requests the Commission to investigate the legislation passed by the various Member States to ensure that safety and caution are observed in the search for and extraction of oil and gas;

3. Requests the Commission to draw up proposals for directives, on the basis of the results of this investigation, harmonizing and, if necessary, tightening up the various national laws.