PETROLEUM REVIEW

VOL. 44 1990

PETROLEUM REVIEW

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Editor
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VOLUME FORTY-FOUR

1990

THE INSTITUTE OF PETROLEUM
61 NEW CAVENDISH STREET
LONDON W1M 8AR

PETROLEUM REVIEW

January 1990 Volume 44 Number 516 £4.50

Subscription (inland) £40.00 (overseas) £50.00

PUBLISHERS

Published Monthly by
THE INSTITUTE OF PETROLEUM

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Printed by Eyre & Spottiswoode Ltd, London and Margate.

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ISSN 0020-3076
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Contents

Cover photo of Conoco's Jolliet tension leg well platform off New Orleans. Photograph courtesy of Conoco.

British Gas ventures into oil

BRITISH GAS has unveiled a new global strategy of entering into the oil market in pursuit of a more balanced oil and gas portfolio.

The aim, as outlined by Cedric Brown, Managing Director for Exploration and Production, is to build up a major exploration and production business geared towards generating profits for the group's shareholders, which includes promoting gas markets worldwide.

E & P assets are valued at over £4 billion and the group's reserves total 2.47 billion barrels of oil equivalent.

'We are interested in oil as much as in gas', said Mr Brown. The oil content of group reserves is 20 percent at present. 'I'd be disappointed if we didn't double the proportion of oil in the next five to 10 years', said Robert Evans, Chairman and Chief Executive of British Gas.

The group will be concentrating on areas where it hopes to find reserves of 50 million barrels or more. These include West Africa, the Middle East, Southeast Asia and the North Sea. Cedric Brown outlined the logic behind the moves. 'First, the required exploration skills for oil and gas are basically the same. On many occasions exploration of an area prospective in one hydrocarbon has resulted in the discovery of the other.

'Second, oil is in many respects easier to market than gas. It is quicker to develop oil discoveries than gas and less dependent on detailed infrastructure'.

With oil companies heavily involved in gas, British Gas sees no reason why it should not be similarly interested in oil. And the group believes that its gas interest puts it at good advantage to exploit fields discovered, but left in the ground, by oil companies during oil exploration.

Around £2 billion has been earmarked for acquisitions as a short cut to establishing an international presence and a means of increasing the group's oil production and reserves base. At present, 90 percent of reserves are in the UK Continental Shelf.

British Gas is about to embark on its first US exploration venture when it signs two separate deals, one in the Gulf of Mexico, the other in Louisiana, worth £70 million.

Another area of interest is India, where £1.5 billion of contracts are at stake. Robert Evans will be flying there next month for talks on gas-fired power generation plants. Other prime areas of interest include the Far East, where interests are held in Indonesia and Malaysia. There have also been recent ventures in Thailand and Pakistan.

BP reserves increase

BP Exploration has increased UK North Sea oil reserves by over 70 million barrels. The increase follows the completion of an intensive technical review of the BP-operated Thistle area, Beatrice and Clyde fields.

Of the increase, some 35 million barrels are the result of incremental reserves associated with the Thistle field, with a further 22 million barrels subject to final partner agreement on appropriate incremental investment.

Some 18 million barrels of incremental reserves have been technically evaluated and added to the Beatrice field.

In a separate move, BP is to make its biggest ever investment onshore in Scotland. The company is to spend a total of £560 million to expand oil and gas processing and to increase ethylene production at its Grangemouth complex near Edinburgh, in Scotland.

The £310 million oil and gas processing project will increase BP Exploration's capacity to transport and process North Sea oil and gas liquids through its Forties pipeline system.

The major part of the activity will be at BP exploration's Kinneil facility — alongside the Grangemouth refinery and petrochemicals complex — which removes the gases from the incoming crude oil carried through the Forties pipeline system. The work includes the installation of an additional gas processing train, increasing the capacity of the plant from 4,000 tonnes a day to 6,000 tonnes a day by autumn 1993.

The expansion of the BP Chemicals Grangemouth cracker to world-class scale will cost around £250 million and is scheduled for completion in mid-1992.

The new facilities will involve the construction of new furnaces, gas compression, and some distillation and separation units. The main expansion will take Grangemouth ethylene cracking to 600,000 tonnes a year, which is necessary to satisfy BP's internal demand, notably polyethylene.

Piper approval

The UK government has approved plans to redevelop the Piper field at a cost of approximately £580 million, of which more than £460 million will be invested in British industry. The project will create an estimated 3,000 jobs largely in the northeast of England and the northeast of Scotland.

The engineering concept for the Piper redevelopment has been designed to incorporate any changes arising from Lord Cullen's Public Inquiry. An independent safety auditor has been appointed to monitor the progress of the project.

The Piper field will be redeveloped using an eight-legged 46,000 tonne steel platform which will be linked to the consortium's existing pipeline system leading to the Flotta oil handling terminal (Orkney). The new platform will be designed to handle up to 140,000 barrels of oil per day and can accommodate 24 wells.

Interests in the Piper Field redevelopment are held by Occidental (operator), Texaco, LASMO and Union Texas Petroleum.

Pakistan finds

Occidental Petroleum Corporation has announced a crude oil and natural gas discovery in the Badin area of southeastern Pakistan, by a joint venture in which it is a partner.

Occidental has a 30 percent interest in the joint venture, as does the operator, Union Texas Pakistan, a subsidiary of Union Texas Petroleum Holdings, Inc. Oil and Gas Development corporation, a Pakistani government-owned company, has a 40 percent interest.

The well oil zone was tested at a daily rate of 433 barrels of 45.8 degrees API gravity oil and 72 thousand cubic feet of gas on a 12/64-inch choke.

Fina invests

Petrofina has decided to invest more than 4 billion Belgian francs in the construction of a new high density polyethylene unit at Feluy, Belgium.

This unit will have an annual capacity of 130,000 tonnes and will be built by Petrochim, a 100 percent Petrofina subsidiary.

OPEC raises ceiling

OPEC raised its production ceiling by 1.5 million b/d to 22 million b/d from 1 January this year. The move was the result of an agreement reached between the 13 members in late November.

The oil ministers also decided to raise the minimum price for OPEC oil, fractionally, from $17.74 a barrel to $18, a move believed to be aimed at satisfying Algeria's demand for a firm price commitment. Production quotas now stand, in million b/d, at: Algeria, 0.83; Ecuador, 0.27; Gabon, 0.2; Indonesia, 1.37; Iran, 3.14; Iraq, 3.14; Kuwait, 1.5; Libya, 1.23; Nigeria, 1.61; Qatar, 0.37; Saudi Arabia, 5.38; United Arab Emirates, 1.1; and Venezuela, 1.95.

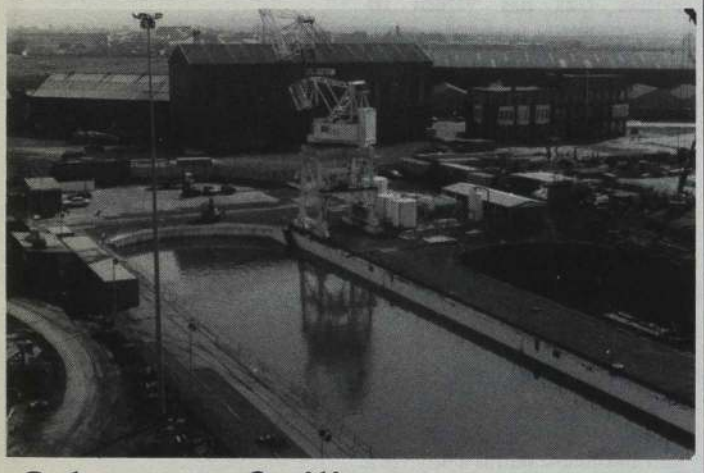
Despite adding his signature to the agreement, the UAE's oil minister, Dr Mana Saeed Otaiba, said that his country did not accept the new quota and would continue to overproduce but at a lower level than the estimated current level of 2.3 million b/d.

OPEC's total production is still expected to be above the new ceiling. Estimates last year put production at around 23 million b/d. An expected slackness in demand this year may, however, put downward pressure on prices if members are unwilling to reduce their output. Saudi Arabia has said it will not sacrifice its own output but the UAE and Kuwait may decide to cut back.

Marathon North Sea discovery

Marathon Oil UK, Ltd, on behalf of the Brae Group, has confirmed a hydrocarbon discovery, adjacent to and partially underlying, its North Brae Field which has been on production since April 1988. The discovery is located 155 miles north east of Aberdeen and is being tested by the drilling rig, Sonat Rather.

The well flowed at a rate of up to 1319 barrels of condensate per day and 12.9 million cubic feet per day of gas, through a ½-inch choke.



Subsea test facility

Teesside's Ocean Technology Centre is a facility enabling seabed systems and equipment for the extraction and transmission of oil and gas, to be developed and tested in the safety of an accessible landbased environment.

Based on two huge converted drydocks in the former shipbuilding yard of Smiths Dock (above), the Ocean Technology Development Centre is a multi-million pound joint venture by Teesside Development Corporation and the specialist offshore subocean engineering company Northern Ocean Services, part of Cable & Wireless plc, which is responsible for the Centre's management.

Conoco and PowerGen gas

Conoco (UK) Limited and PowerGen are to form a joint venture company to transport natural gas for use in power generation — the first such venture between a major gas producer and an electricity generator in Britain.

PowerGen, one of the generating companies being formed under the UK government's privatisation of the electricity supply industry, will become equal partners with Conoco in the new company, known as Kinetica Ltd.

Kinetica's first project is to build and operate a 50 kilometre 20 inch pipeline from the Conoco-operated gas terminal at Theddlethorpe, Lincolnshire, to PowerGen's proposed new combined-cycle gas turbine (CCGT) power station at Killingholme, South Humberside. An application for consent to build the pipeline is planned to be submitted soon.

Alf Roberts, PowerGen's Executive Director, said that he hoped to see far higher levels of gas being used for power generation in the United Kingdom. He expected 10 percent of energy production to come from gas by the end of 1993 and at least double that amount by the end of the century. Kinetica's strategy will be to take up opportunities in gas transportation and to market gas for commercial and industrial users as direct sales.

The Killingholme PowerGen power station has been designed to use combined-cycle gas turbine (CCGT) technology. The CCGT plant makes use of the hot exhaust gases to produce steam which drives a turbine coupled to its own generator. In engineering terms, CCGT plant achieves an efficiency of about 48 percent compared with some 33 percent from less advanced gas turbine plant and about 35 percent from a coal-fired station. Conoco and PowerGen stressed environmental advantages of CCGT technology.

Mobil gas strike

Mobil North Sea Ltd has announced another new gas discovery in its 100 percent Block 53/2, some 6 km away from its Camelot 3 unmanned platform.

The 53/2-8 wildcat, drilled by the Ocean Benarmin, was spudded on 14 August and reached a depth of 6,687 feet, encountering gas below 6,300 feet.

Although the well was not tested, reservoir quality is similar to that seen in the Camelot fields where flow rates of up to 40 million cubic feet per day have been achieved. Mobil says the new structure is a candidate for early development.

Vietnam plug

Enterprise and its partner Compagnie Europeenne des Petroles (CEP) have plugged and abandoned their well in Block 17 offshore Vietnam. The rig is to be released.

Enterprise and CEP signed Production Sharing Contracts with Petrovietnam on 14 April 1989 to explore two Blocks — 17 and 21 — offshore Vietnam. The Block 17 well is the first to have been drilled by Western companies since the current round of licensing.

Kelt loan

Kelt has entered into an agreement with the European Investment Bank (EIB) for a 15 year loan facility to the Kelt Group. The purpose of the EIB loan of £33.6 million is to assist the Kelt Group in the financing of its share of the development costs of the Wytch Farm Oil Field.

Lloyd's service

Lloyd's Register has launched a new lubricating oil testing service, LQS–Lubricant Quality Scan. The new service complements the Fuel Oil and Bunker Analysis and Advisory Service and is applicable to offshore rigs and power plants.

. . . news in brief

9 November

The UK government has reversed its decision to privatise the nuclear power industry.

Algeria has signed an oil exploration contract with a consortium including Total, Kuwait Foreign Oil Exploration Co and Repsol Exploration SA which covers an area in the Ghadames Basin near the Libyan border.

The Argentine Energy Secretariat announced that foreign oil companies which sign new contracts will be able to refine and market the petroleum they recover.

The government of the Philippines have signed a letter of intent with Cogentrix Inc to build a $340m coal-fired cogeneration plant adjacent to the Caltex Philippines refinery on the island of Luzon.

10 November

Petrofina SA announced plans to invest BFr.4bn in a high density polyethylene plant at Feluy, Belgium.

Ranger Oil Ltd have bought various oil and natural gas properties from Petro Canada Inc for an undisclosed sum.

The President of Ecuador has approved loans from Argentine and Colombian firms for a total of $69.6m to build 373km of pipeline to transport oil products.

13 November

The decision by the UK government to cancel its programme for new PWRs nuclear stations should mean larger exports of power from Scotland to England.

KWU have won an order to build a power and heat production plant about 25km north of Copenhagen from the Danish IFV power company.

Sri Lanka will purchase up to 30m barrels of Iranian crude oil annually, or an average 82,000 b/d.

14 November

BP has added 70m barrels of oil to its reserves booked in the North Sea after a technical review of the fields it acquired when it took over Britoil.

Phillips is leading a group of five companies which will pay US$134m for a 57.67% share of Harriet and associated production and exploration permits off Western Australia.

Italy and Algeria will build a fourth gas pipeline to carry Algerian exports to Italy and will develop cooperation in petrochemical projects.

15 November

Abu Dhabi is planning to boost sustainable oil output capacity at the offshore Upper Zakum field to 500,000 b/d from the current 320,000 b/d.

BASF Japan Ltd and Mitsubishi Petrochemical Co Ltd have set up a new firm in Japan to market and manufacture engineering plastics.

Syria is negotiating with a number of international oil companies to award new oil exploration concessions.

South American Petrolite of Venezuela has opened the country's first plant to produce chemicals for oil industry use in the northern city of Barcelona.

16 November

Ultramar has acquired a larger share of the potentially lucrative Caister gas field in the southern sector of the North Sea in an asset swap arrangement with Elf.

The Japanese Fair Trade Commission has raided offices of major Japanese oil companies on the island of Hokkaido on suspicion of forming of a price cartel for domestic heating oil.

17 November

Seven oil companies have been granted exploration permits committing them to Aus$120m expenditure on Australia's continental shelf over the next 6 years.

China's rapidly rising domestic demand for oil products has led to a sharp increase in petroleum imports in 1989, while crude oil and products exports have fallen.

Norsk Hydro is set to gain a 20% stake in an exploration concession off Borneo through a farm-in agreement with Elf.

Phillips Norway expects to spend up to NKr140m converting two production platforms in the Greater Ekofisk area of the North Sea to remote control to keep them profitable.

20 November

The Indonesian Mines and Energy Minister said Indonesia was willing to reduce its share of an expected increase in oil production quotas to settle a disagreement with OPEC.

Esso Nederland plans to subject all its staff to compulsory tests for drugs and alcohol.

The Venezuelan energy minister said that his country will consider broad-ranging partnerships with multinational corporations in oil exploration and refining, as well as construction and renovation of plant facilities.

Solvay, the leading Belgian chemicals company, announced plans to regroup its West German interests into a new holding company in an operation expected to yield tax benefits and increase the financial resources of the parent group.

21 November

The UK Energy Minister said that Britain's capital spending on the North Sea oil industry is expected to reach £3.7bn in 1990.

New Zealand Oil and Gas Ltd plans to buy 33.6% of Australia's Pan Pacific Petroleum NL from Otter Exploration NL.

Private, foreign and local companies could now set up and operate oil and gas refining and processing facilities under cooperation agreements with Pertamina in Indonesia.

22 November

Marathon has confirmed a North Sea discovery in the vicinity of its North Brae field.

British Petroleum Canada Inc said it is raising its 1990 exploration and production spending by 25% to C$110m from an estimated C$70m to C$80m in 1989.

Japanese refineries are operating refineries at about 70% of capacity for the first time in 10 years.

23 November

British Gas has valued its exploration and production assets at more than £4bn.

Total-CFP and Elf Aquitaine are to take over the French government-owned Orkem chemical group under a restructuring plan.

The Dutch government plans a tax of 10.3 guilder cents per litre on road vehicle diesel prices from January to raise Gu.540m a year for environmental protection.

27 November

The Swedish company Nynas Petroleum is ready to build a second tanker with a double bottom and double skin as it believes a market will develop for strengthened tankers to meet growing environmental concerns.

The Islamic Development Bank has signed a $10m agreement in Jeddah to finance imports of crude and oil products by South Yemen.

28 November

The Asian Development Bank has approved a $31.5m special assistance loan for oil supply to Nepal.

29 November

Ecuador expects to issue a request for bids for new oil exploration contracts.

Premier Consolidated Oilfield is to embark on an exploration and appraisal programme offshore Thailand in a follow-up to the Songkhla discovery made last year.

Combustion Engineering Inc and Neste Corp signed a joint venture agreement with the Soviet Union to build and operate a $2bn petrochemical project in Siberia.

30 November

Conoco has signed an agreement to participate in a joint venture to build and operate a natural gas processing plant in the Republic of Trinidad and Tobago.

California's Attorney General said a settlement was reached with Shell Oil Co in which the Company will pay almost $20m as a result of an oil spill at a Shell refinery near San Francisco Bay in 1988.

1 December

Occidental Petroleum have received UK government approval to redevelop the Piper oilfield.

The Chairman of Texaco Inc cautioned against ill-considered solutions to the growing problem of world pollution.

4 December

Contracts between British Coal and National Power and Power Gen to be formed on privatisation of the electricity industry will be finalised with an order for 70m tonnes.

Libya has signed a major oil and gas cooperation agreement with Spanish companies. The pact includes the renewal of oil and LNG supply contracts with Spain and Libyan investment in Spanish petroleum distribution assets.

Chevron Corp is seeking to complete the sale of its US Bahamas oil refinery and terminal in the first quarter of 1990.

5 December

The West German firm Wintershall AG has set up a joint venture with Austria's OeMW AG to build a 560km natural gas pipeline from Ludwigshafen in central Germany to Rysum, near the North Sea.

Mobil Exploration have signed an accord with Zimbabwe to drill for oil on the southern shore of the Zambezi River and Lake Kariba.

The Institute of Petroleum

IP WEEK 1990
19th–22nd FEBRUARY

London

The Programme of Events organised by The Institute of Petroleum for IP Week 1990 is as follows:

MONDAY 19 FEBRUARY

A half-day afternoon Conference on **New Opportunities for Fuel Oil in Power Generation,** organised by the IP Energy Economics Group, to be held at the IP (Contact: Susan Ashton.)

TUESDAY 20 FEBRUARY

A half-day morning Seminar on **Oil Price Information**. To be held at the Institute of Petroleum, and organised by the Information for Energy Group, this Seminar will be particularly of interest to those involved in trading, marketing, forward planning and information services. (Contact: Jean Etherton.)

Mr Robert Evans, CBE, Chairman and Chief Executive, British Gas plc, will speak at an **IP Luncheon** to be held at the Inn on the Park Hotel. (Contact: Caroline Little.)

Mr N Pattison of Shell UK Oil will speak to the IP's London Branch on the subject of **'Unleaded Gasoline — the Future'** at 18.00 at the Institute. (Contact: Mary Wood.)

WEDNESDAY 21 FEBRUARY

The IP Annual Dinner will be held at Grosvenor House, London at 18.45 for 19.30. (Contact: Caroline Little.)

THURSDAY 22 FEBRUARY

An **IP Luncheon** to be held at The Savoy Hotel (Contact: Caroline Little.)

Mr Graham Hearne, Chief Executive of Enterprise Oil will speak to the IP's Exploration and Production Discussion Group on the subject of **The Future of the Independent Oil Companies** at 17.30 at the IP. (Contact: Alan Lodge.)

For further information on any of the events during IP Week 1990, please contact the individuals mentioned above at The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Telephone: **01-636 1004**. Telex: **264380**. Fax: **01-255 1472**.

Government commitment to Environmental Protection Bill

Mr David Trippier MP, Minister of State for Environment and Countryside, Department of Environment, gave the keynote address to the IP Conference on 'Automotive and Industrial Fuel Combustion — Environmental and Health Implications' on 22 November 1989. His speech is reproduced here:

The environmental concern felt by millions of individuals, in this country and in others, is not a momentary trend, a bubble blown by the popular press that will soon burst and leave no trace. That concern has been generated by our rapidly increasing awareness that man's activities during the industrial age have had a huge, often hidden, and possibly irreversible effect on his surroundings. In the words of the Prime Minister a year ago, we may have begun a massive experiment with the systems of the planet itself.

We are in a race to improve and extend our scientific understanding of these processes before the moment has passed when we can take the necessary action to mitigate the adverse consequences. We can take heart from the timely warning that was given by the scientific community in this country, in the United States and elsewhere, about the harm done to the earth's protective ozone layer. The observations of the British Antarctic Survey, of changes in the stratosphere above the South Pole, rang the warning bells. Combined with other scientific findings, they left the world community in no doubt that a range of substances used widely in modern industrialised society — principally the chlorofluorocarbons (CFCs) — were causing extensive damage to the ozone layer.

We have taken that warning to heart. An initial, but very important, step was our signature of the Montreal Protocol in September 1987, together with our EEC partners, pledging a 50 percent reduction in the production and consumption of the fully halogenated CFCs by 1999. We now recognise that the reduction targets in the Montreal Protocol need to be raised. Indeed, we have called for the total elimination of CFCs by the end of the century. In 1990, we shall be hosting in London a meeting of the parties to the Montreal Protocol, to review, and surely to strengthen, the control measures.

The overriding significance of the Montreal Protocol, however, is that it demonstrates that the international community can concert its efforts to provide an effective response to an environmental threat on a global scale.

Greenhouse effect

That must be our objective in facing up to the still more serious problem of climate change — the greenhouse effect. Recently the Prime Minister took this as a central theme of her address to the UN General Assembly. At the same date I met fellow environment ministers from many countries at the Noordwijk conference in the Netherlands. My comments to you reflect the urgency and seriousness of the concern which the world community now feels towards the prospect of global warming.

There is no scientific certainty about the rate and extent of climatic change. International efforts to remove the uncertainty are being coordinated by the Intergovernmental Panel on Climate Change, whose report will be considered by the world climate conference in a year's time. We shall be reinforcing these efforts by setting up a new centre for the prediction of climate change, which will provide experts from home and abroad with advanced facilities to improve our ability to predict the scale and incidence of climate change.

However, it is already clear that the effects of global warming over the next half century may well include higher sea levels, changing patterns of agriculture, and modified occurrence of diseases and pests. Current forecasts suggest that global temperatures could rise by between 1·5 and 4° Celsius by the middle of the next century — a warming rate 10 times higher than anything experienced in the last million years.

If such forecasts are borne out by further scientific work, the need for effective action by the world community will become even more pressing. We have proposed that there should be a global climate convention to guide international action, and I am glad to say that this proposal has been widely supported, as the Noordwijk conference again demonstrated.

What can be done to counter the threat of global warming? We cannot give a full answer to this question until we have a better understanding of the processes that are at work. But attention is bound to focus on the so-called 'greenhouse gases.' These include CFCs, which before the Montreal Protocol were estimated to contribute around 20 percent to global warming. Full implementation of the Montreal Protocol would however mean that CFCs became far less important over the next half-century.

Methane and nitrous oxide are also significant in this context. But the gas contributing most to the 'greenhouse

effect' — over 50 percent — is carbon dioxide. A number of human activities are responsible for emissions of carbon dioxide to the atmosphere. Transport and electricity generation each account for over 20 percent. Any action to tackle CO_2 levels in the atmosphere will inevitably have major implications for the use of fossil fuels in these activities.

We have already called on the EEC commission to make proposals on reducing CO_2 emissions from cars. We are also hoping for the early revision of the gas generation directive, to make it possible for the carbon emission advantages of natural gas to be exploited more fully. We have set ourselves a goal of a 20 percent increase in energy efficiency by 1995. These developments will crucially affect your industry and you will play a key role in the process of changing from established patterns of fuel use to whatever new patterns are required to meet the environmental imperative.

Unleaded petrol

The industry has already demonstrated how effectively it can help to achieve a more limited, but still very desirable environmental objective, in its contribution to the success of the unleaded petrol campaign. The fuel now has a 26 percent market share, compared with under 1 percent a year ago. With a continued growth in sales, we can be sure of a significant drop in the quantity of lead in the air. This will be of lasting benefit to the environment and will guard against risks to health, particularly for children.

Petrol companies and retailers have given a real boost to the campaign by ensuring that unleaded petrol is available at nearly all outlets.

But I must add a word of warning. Much goodwill has been earned by the industry's contribution to the campaign. However, it may be squandered if care is not taken by those companies promoting super unleaded petrol. There is a risk that some motorists may be persuaded to use this fuel, even though their cars could run equally well on the cheaper, premium unleaded fuel. The companies that have introduced the new fuel need to guard against consumer confusion. Otherwise, we could see a general backlash against unleaded fuels.

Vehicle emission standards

The near universal availability of unleaded petrol has a two-fold importance in giving motorists an immediate opportunity to switch to an environmentally more benign fuel and in paving the way for the use of vehicles fitted with catalytic converters. The EEC agreement in June 1989 on tough new standards for small car emissions of nitrogen oxides, carbon monoxide and gaseous hydrocarbons will be complemented by matching standards for medium and large cars. From 1993, all new petrol-engined cars will need 3-way catalysts to meet these new standards and will have to use unleaded petrol.

David Trippier MP

As I have already said, we have pressed the Commission to make proposals for limiting vehicle emissions of carbon dioxide as well. We have also called for new EEC standards for emissions for diesel engines for use in HGVs, coaches and buses, covering gases and particulates. These would be as stringent as those due to come into force in the United States in the 1990s. Discussion is underway in the EEC on a possible directive on volatile organic compounds (VOCs). We are also working hard in the UN Economic Commission for Europe towards a protocol on VOCs.

Integrated control

This applies equally to pollution from stationary sources, such as refineries. Besides acting on VOCs, we are determined to implement fully the EEC directive on large combustion plants which was agreed in 1988 and to reduce emissions of sulphur dioxide and nitrogen oxides from this source. We explained our proposals for implementation in a consultation paper issued last August. We have received helpful responses from the oil industry and others, and we are now considering them.

The Queen's Speech confirmed our commitment to presenting an Environmental Protection Bill during this session of Parliament. At the heart of that Bill will be the introduction of a new system of integrated pollution control, to apply to the industrial processes with the greatest polluting potential. Operators will be required to keep polluting emissions to a minimum and to use the best practicable environmental option to deal with them, under the control of Her Majesty's Inspectorate of Pollution. Protection standards will be based on the best available technology, not entailing excessive cost.

The Bill will provide for the full implementation of the large combustion plants directive, by placing on the Secretary of State the duty to make a formal plan for the reduction of national emissions of particular pollutants. The authorisations which the Inspectorate of Pollution will give to relevant individual processes will comply with the requirements arising out of this plan, as well as best available technology, and with any emission limits and quality standards that have been set in regulations. Criteria will be overriding.

A further feature of the new legislation on integrated pollution control will be the provision of a public right of access to environmental information. Registers would be maintained including details of authorisations given by the Inspectorate of Pollution and of monitoring and enforcement of those authorisations. We consider that these proposals are an appropriate response to the widespread desire of the public to have a better insight into the workings of our pollution control systems and that they will reinforce public confidence in the effectiveness of those systems.

Your industry occupies a very important position in the field of environmental protection. You handle a resource which is essential to our modern way of life, which has long demonstrated its enormous utility, but which also has an undoubted potential for pollution. Your knowledge, your experience and your sense of responsibility will all have to be brought fully into play if we are to ensure that the responses that we fashion to current environmental threats respect the long-term needs of our planet as well as meeting the immediate challenges of today's society. ■

Health effects of automotive exhaust gases

By Professor Paul Grasso, Robens Institute of Industrial and Environmental Health and Safety, University of Surrey

Motor vehicle exhaust gases are an important source of pollution of urban air and there is some concern about their possible adverse effect on health.

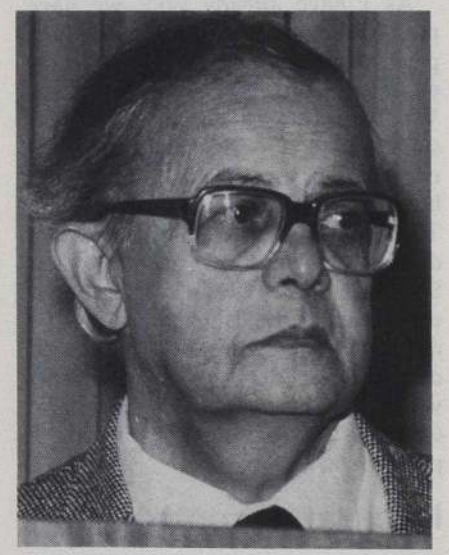
It is usual to separate automotive emissions into two distinct classes — those that are produced by gasoline engines and those produced by diesel engines. Diesel exhaust contains a much higher proportion of particulates than gasoline engine exhaust. In fact the sooty exhaust emanating from the diesel engine cannot fail to attract the attention of the general public, and perhaps it is for this reason that the hazards to health from diesel exhausts and in particular the carcinogenicity hazards have been examined much more extensively than those from gasoline exhaust.

In this presentation, I would like to draw attention to the experimental and epidemiological evidence that has been generated in response to the concern about the carcinogenic hazards from diesel exhaust.

Two types of experiments have been conducted in order to investigate the carcinogenicity of emissions from diesel engines. In one type the diesel exhaust was condensed and the condensate extracted by organic solvents. The residue left after evaporating the solvent was then applied to mouse skin. The early experiments carried out by Hoffmann (1965) were inconclusive. Nesnow et al (1982) have studied the carcinogenicity of these condensates under controlled conditions. They carried out two kinds of experiments on the skin of SENCAR mice — one was an initiation/promotion experiment and the other a complete carcinogenicity study.

In the initiation/promotion experiment (**Table 1**) they used extracts of particulates from four diesel engines and from one gasoline engine. Extracts from the condensates of roofing tar and coke oven particulate emissions, which are known to contain a high concentration of polycyclic aromatic hydrocarbons (PCAs), were also included.

The extracts were applied once only to the dorsal skin of the mouse and the site was then treated with twice weekly applications of a promoter (Tetradecanoyl phorbol acetate or TPA). The extracts obtained from the exhaust of three of the four diesel engines showed some 'initiating' activity, (**Table 1**). That from a Datsun engine was the most active in this respect but surprisingly the extract derived from a heavy-duty engine was completely negative. The extract from the coke oven emissions was a much stronger initiator than any of the diesel engines but the extracts from the roofing tar had approximately the same potency. The gasoline exhaust was a weak initiator (**Table 1**).



Professor Paul Grasso

Studies of this sort are useful for comparing the potential carcinogenic activity of one test substance with another but are extremely difficult to use in making a risk analysis. This is particularly so for diesel exhaust since humans are exposed to diesel exhaust by the inhalation route.

Studies of 'complete' carcinogenesis on mouse skin are more relevant to risk analysis since cigarette smoke, a known human carcinogen, is strongly positive in this system but, of course, like all experimental results, they cannot provide the definitive answer.

Of the condensates from the four types of diesel engines that were studied in the initiation/promotion study, only the extract from the Datsun engine was tested for complete carcinogenicity and, compared with the results of coke oven emissions and roofing tar extract, it proved to be a

Table 1: Relative potency in initiation/promotion tests

Sample		Papillomas/mouse at 1mg of extract
Topside coke oven	M	2.2
	F	2.0
Datsun	M	0.49
	F	0·68
Roofing Tar	M	0·38
	F	0·44
V W Rabbit	M	0·21
	F	0.17
Mustang	M	0.17
Gasoline	M	0.17

Table 2: Tumours observed following application of extracts to mouse skin for 50 weeks (%)

Dose*		Coke Oven	Diesel Soot**	Roofing Tar
100	M	5	0	0
	F	5	0	0
500	M	36	0	0
	F	30	0	0
1000	M	48	0	3
	F	60	0	0
2000	M	82	0	3
	F	78	0	8
4000	M	98	3	25
	F	75	5	28

Group of 40 Sencar mice of each
*ug/mouse/week **From Datsun engine

Source: S. Nesnow et al, *Journal National Cancer Institute*, 1983.

very weak carcinogen (**Table 2**). It is very likely that, in this model, the other diesel extracts would have produced less tumours, or nothing at all, since they were much less active as initiators.

Thus, both the initiation/promotion experiment and the one on complete carcinogenicity indicate that the diesel exhaust emissions were at worst, weakly carcinogenic. This picture is not, however, as reassuring as one might think, since coke-oven emissions are known to be carcinogenic to man when inhaled, (IARC 1984) so that the possibility of a potential hazard to man from diesel exhaust, although a small one, cannot be entirely dismissed.

Table 3: Exhaust emissions

1. Gasoline (unleaded) — Renault R18
2. Gasoline — catalyst — Renault R18
3. Diesel — V W Rabbit
4. Filtered diesel — V W Rabbit
5. Air Control —

Source: CCMC 1986 Report.

Inhalation experiments are more relevant for assessing hazard to man from diesel exhaust since the route of exposure is similar to that of man. At least four experiments were conducted on rats, two or three in the mouse and one in the hamster. It is not certain whether these inhalation experiments on diesel exhaust were inspired by the results of the skin-painting studies. In all probability these skin-painting experiments had very little to do with the development of an interest in the inhalation toxicology of diesel exhaust. Public concern in environmental pollution probably had a much larger share in creating an interest in this area.

Table 4: Exposure conditions

Type of exposure	Whole body
Duration	16 hours
Exposure/week	5 days
Total duration	104 weeks
Length of recovery	26 weeks

Source: CCMC 1986 Report.

Experiments on rats

The studies in mice and hamsters are inconclusive so that in this presentation I shall confine myself to the rat studies which have provided some interesting results.

One of the more important experiments in rats, designed to investigate the carcinogenicity of diesel exhaust by inhalation was conducted by the Committee of Common Market Automobile Constructors (CCMC).

It is important because the number of animals used was adequate (three) and because filtered diesel exhaust and gasoline exhaust were included as controls. Furthermore, it would appear that the conditions under which the experiment was carried out were also strictly controlled (**Tables 3–6**).

The results from this study indicate that a significant increase in the number of tumours occurred at the medium and highest doses (**Table 6**) but it is important to note that there was no response at all at the lowest dose ($0.7mg/m^3$) suggesting the possibility of a threshold.

Other workers obtained similar positive results when they exposed rats to diesel exhaust. Thus Iwai (1986) found a high incidence of lung tumours when he exposed rats to diesel exhaust diluted 1 in 10 and containing approximately the same particulate concentration as the CCMC experiment (**Table 7**). As in the CCMC experiment, filtered exhaust did not produce any adverse effect. Iwai concluded that the particulate matter in the diesel exhaust was the principal cause of the lung tumours.

Mauderley et al (1987) came to the same conclusion. These authors exposed rats to three different concentrations of diesel exhaust five days a week for 30 months and found a dose-related incidence of tumours (**Table 8**).

In the course of these experiments, it was observed that the lungs of rats exposed to diesel exhaust were grossly discoloured and appeared a dark brown to black. Histologically, the alveoli of the lung were full of macrophages containing numerous carbon particulates. Both the discoloration and the carbon-laden macrophages were particularly pronounced at those exposure concentrations which were high enough to induce tumours.

Little attention was, at first, paid to these pathological observations and attention was directed to the benzo(a)pyrene content of the particles. In

Table 5: Dosing (particle concentration)

mg/m^3

	Mean	SD
Diesel Low Dose	0.70	0.19
Diesel Medium Dose	2.20	0.40
Diesel High Dose	6.60	1.30

(Urban levels 0.0002–0.002)

Source: CCMC 1986 Report.

Table 6: Lung tumours from exposure to diesel exhaust

	Males		Females	
Dose	No.	Tumours	No.	Tumours
Low	72	1	71	0
Medium	72	3	72	11
High	71	16	72	39
None	134	2	126	1

No increase in tumour incidence was observed in rats treated with filtered diesel exhaust or gasoline exhaust.

Source: CCMC 1986 Report.

Table 8: Rats* with lung tumours (%) following inhalation of diesel exhaust

Group	High	Medium	Low	Controls
Particulate conc. (mg/m^3)	7.0	3.5	0.35	0.001
TUMOURS				
Adenomas	0.4	2.3	0	0
Carcinomas (Adeno and Sq.)	7.5	0.5	1.3	0.9
Squamous cysts	4.9	0.9	0	0
TOTAL	12.8	3.7	1.3	0.9

Source: J. L. Mauderley et al, *Fund. Appl. Toxicol.*, Vol 9, pp 208–221.

order to elucidate the role of B[a]P in the production of lung tumours in rats by diesel exhaust, a laboratory method was devised to produce an emission rich in B[a]P and in particulate matter. This (Heinrich et al 1986) type of emission was generated by pyrolising pitch or tar in a coal oven and adjusting the particulate concentration to be as near as possible to that of diesel exhausts.

Although the particulate concentration (**Table 9**) in the fumes from pyrolised pitch were close to that found in diesel exhaust, the B[a]P content was very different: in diesel exhaust it was $5ng/m^3$, while in that from pyrolised pitch it was 3,000 times this figure. There is another major difference — the carbon content of the particulates in diesel exhaust is very high (80 percent) while in the fumes from pyrolised pitch it was low.

When the two fumes, suitably diluted, were tested for carcinogenicity, there was little difference in the tumorigenic response (**Table 10**). The lung pathology was, however, very different. Although some evidence of lung damage was present in the rats exposed to fumes from pyrolised pitch, there was no crowding of macrophages in the alveoli, as seen in animals exposed to diesel exhaust. Evidently, B[a]P was the main agent responsible for the production of lung tumours by pyrolised pitch, whereas another mechanism must have operated in the case of diesel exhaust.

Mohr (1986) conducted a similar experiment, using coal oven flue gas, also rich in carcinogenic PCAs, in place of fumes from pyrolised pitch and obtained results similar to those mentioned in the previous paragraph (**Table 11**).

Several short-term studies were conducted to gain an insight into the possible mechanism by which diesel exhaust caused lung tumours in rats. (For review, see Grasso et al 1988). Studies of this sort, lasting a few weeks, revealed that at high concentrations ($6.0–7.0mg/m^3$) there is a rapid accumulation of macrophages containing numerous carbon particulates in the lung alveoli. The carbon particles in diesel exhaust are quite small (approximately 0.5 to 1.0 microns in diameter), so that they easily pass through the bronchial tree and into the alveoli. There they are phagocytosed by alveolar macrophages. If the amount of particles inhaled is small, then the macrophage response is mild. These cells then make their way back into the lymphatics or ascend to the larynx on a carpet of mucus which is impelled upwards by ciliary action (the so called muco-ciliary escalator). This mechanism ensures that the alveoli are kept clear of carbon particles (or any other type of particle of a similar size). If, however, the amount of carbon particles delivered to the alveoli is large, then the macrophage response is marked, resulting in a rapid accumulation and crowding of particle-laden macrophages in the lung alveoli. This results in a situation similar to that of a massive traffic jam. This 'traffic jam' affects the mobility of macrophages, so that the clearance of the carbon particles is seriously compromised. This situation has been demonstrated experimentally. When rats were exposed for several days at varying concentrations of diesel exhaust, then the clearance of inhaled radio-active particulate matter differed considerably. At low concentrations (for example $2000mg/m^3$) the clearance rate was virtually the same as in unexposed controls, but at the high concentration, (for example $6000mg/m^3$) the clearance rate was virtually nil (Chan et al 1981).

Table 7: Lung tumours from exposure to diesel exhaust* for 2 years

	No.	With Tumours
Control	22	1
Filtered	16	0
Whole	19	8

Group of 24 female rats.
*Diluted 1 in 10/air

Source: K. Iwai et al in N Ishinishi et al (eds), *Carcinogenic and Mutagenic Effects of Diesel Engine Exhaust* (Elsevier, 1986).

These results suggested that a blockade of the clearance mechanism may be responsible for the production of the tumours and this hypothesis was tested by exposing rats by the inhalation route to high concentrations of dusts which were known to be free of carcinogens. As shown in **Table 12** two dusts were employed: TiO_2 and Quartz (Heinrich et al 1986). Under these conditions the two dusts induced lung tumours. Compared with the concentrations of diesel exhaust, the atmospheric concentrations at which these dusts were tested is extremely high, so that although they support the suggestion that the high concentration of particulate matter in diesel exhaust plays a major role in the production of tumours, the possibility that some other factor might be operating cannot be entirely excluded.

It would thus appear that the causation of the lung tumours by diesel exhaust is imperfectly understood. Nevertheless there would appear to be a clear threshold between $350–3500mg/m^3$ (Mauderley 1987). The existence of this threshold provides some reassurance that if the dose is low enough so that the mechanism for particulate clearance from the alveoli is not interfered with, there is very little likelihood that pulmonary cancer will be produced. The kerbside concentration of diesel particulates in urban air is between $0.002–0.0002mg/m^3$ (see **Table 5**) which is approximately 1,000

times less than the concentrations which produced tumours in inhalation experiments in rats. At such levels the risk of cancer induction by diesel exhaust is very small indeed.

Epidemiology studies

The interest shown in the carcinogenicity of diesel exhaust led to several epidemiological studies. I shall try to summarise the more important of these without any reference to the chronological order in which they appeared in the literature. These studies were conducted on workers whose occupation exposed them to the inhalation of diesel fumes, so that they represent groups of people who had a greater exposure to diesel exhaust than that of the general public. The occupational groups investigated were:

- Londn Transport drivers;
- Railway workers in the United States and Canada;
- Taxi and truck drivers.

cancer was decreasing, while the use of diesel engines in trucks and lorries was increasing.

Rushton (1980) conducted three large epidemiological studies on behalf of the Institute of Petroleum on London Transport workers. In one of these studies 8,490 male workers in 71 London garages were studied. The men were in almost continuous employment for approximately 10 years. The SMR was 101 when compared with that of the population of the Greater London area. Unfortunately exposure data were not available and the follow-up lasted only six years, so that the study was thought to be of little value in assessing the risk from diesel exhaust.

Railway workers

Four thousand three hundred and eighty two retired workers from the Canadian Railways were studied by Howe in 1983. They were at work with

tions, among which were those that involved exposure to diesel exhaust. He found an RR of 1.42 for those exposed to diesel exhaust, compared with the non-exposed. This figure has been much quoted as evidence for the carcinogenicity of diesel exhaust but the 95 percent confidence limits of the RR is wide (0.45–2.39) so that the figure of 1.42 is misleading.

Garshick (1987) followed up this investigation with a case-control study in which they analysed all deaths from lung cancer which occurred from March 1981 to February 1982 among 65,000 workers from the US railways. All of these cases had at least 10 years of service. Each death was matched with two controls randomly selected from deaths other than cancer. Smoking history was taken into account. They found that the RR was not significantly elevated for those with more than 20 years service since these would have worked before the introduction of diesel, but the RR was significantly elevated at 1.41 in lower

Table 9: Differences between particulate matter emitted from diesel engine and coal-oven pitch pyrolysis (COP)

	Emission Source	
	Diesel Engine	COP
Adsorbed organic material (AOM)	20%	>90%
Carbonaceous core	80%	<10%
BaP content of HOM	5ng/mg	15,000 ng/mg

Source: U. Heinrich et al in N Ishinishi et al (eds), *Carcinogenic and Mutagenic Effects of Diesel Engine Exhaust* (Elsevier, 1986).

Table 10: Lung tumours in mice exposed to diesel exhaust (DE) or to coal-oven/ pyrolized pitch (COP)

	Particle Concentration	Tumour bearing rats (%)
DE (unfiltered)	4mg/m^3	16
COP	1.1mg/m^3	18

Source: U. Heinrich et al in N Ishinishi et al (eds), *Carcinogenic and Mutagenic Effects of Diesel Engine Exhaust* (Elsevier, 1986).

London Transport drivers

In 1957 Raffle compared the incidence of lung cancer among London Transport staff with that of the general population. No increased incidence was found but the study was regarded as inadequate because diesel engine transport had been introduced less than 10 years prior to the commencement of the study.

Waller conducted a much more comprehensive study which he published in 1981. He found that the standard mortality rate (SMR) for deaths from lung cancer for five job categories — bus drivers, conductors, engineers in garages and engineers in central works and motormen or guards on the Underground — was lower than that of the general population. He noted that the national trend for lung

Canadian Railways from 1965–77. The relative risk* (RR) ratio for non-exposed, possibly exposed and probably exposed was 1.2, 1.35, 1.35, showing a slight positive trend. The workers were on active service during the period when the railways were being converted from coal to diesel power. The same positive trend was observed when workers were classified according to coal dust exposure, so that this study is inconclusive.

In the following year, Schenker (1984) conducted a pilot study in an attempt to identify those occupations which could lead to an increased cancer risk. He listed 150 job classifica-

age groups. Adjustments were made for asbestos and smoking. The authors concluded that the results supported the hypothesis that workers in jobs which involve exposure to diesel exhaust may have an elevated risk to lung cancer.

In a subsequent paper it was reported by the same group of authors that diesel-engine drivers are exposed to smoke in the cab of the railway engine but qualitative analysis of the smoke showed it to be mainly tobacco smoke (Woskie et al 1989).

Taxi and truck drivers

Taxi and truck drivers have had considerable attention drawn to them. At least six fairly detailed studies have been reported.

Damber and Larsson (1985) compared lung cancer incidence of taxi

***The ratio obtained by comparing the incidence of tumours in groups of people occupationally exposed to diesel exhaust with that of unexposed population.**

Table 11: Lung tumours (%) in Female wistar rats exposed to unfiltered diesel exhaust or coal-oven flue gas

	Broncoalveolar hyperplasia	Adenoma	Carcinoma (Adeno and Squamous)
Controls	1	0	0
Diesel	98	7	9
Coal-oven	43	<1	18

Source: U Mohr et al in N Ishinishi et al (eds) *Carcinogenic and Mutagenic Effects of Diesel Engine Exhaust* (Elsevier, 1986).

Table 12: Lung tumours in mice exposed to various dusts

	Particle Concentration	Tumour bearing rats (%)
Coal dust	200mg/m^3	11
TiO_2	151	24
Quartz	60	30
Control	negligible	1

Source: U Heinrich et al in N Ishinishi et al (eds), *Carcinogenic and Mutagenic Effects of Diesel Engine Exhaust* (Elsevier, 1986).

drivers who smoked with that of non-smoking drivers and found that the smoking drivers had a substantially higher incidence of lung cancer than the non-smoking drivers. In this latter group, however, the lung cancer incidence was higher than non-smoking non-drivers but the difference was not statistically significant.

Recently, Ballarajan (1988) carried out a study on 3,392 London professional drivers who had been on the job for at least 10 years. He found a significant excess of lung cancer for all drivers as a group and for lorry drivers as a sub-group. There was also an increase which was not statistically significant for bus/coach drivers but no increase for taxi drivers. The authors state that on the basis of crude assessment of exposure profiles the excess of lung cancer in bus/coach and lorry drivers was due to smoking habits.

Williams (1977) and Milne (1983) carried out studies aimed at identifying industries in which there was a higher than expected incidence of lung cancer. Both identified exposure to gasoline or diesel exhaust to be associated with an increased incidence of lung cancer but both authors acknowledged that driving is included among occupations having a high proportion of smokers.

Two other studies were published in 1988. Siemiatycki carried out a series of case/control studies to see whether a link exists between cancer and any one of 10 types of exhaust. Gasoline and diesel exhaust were associated with an increase in lung cancer (RR 1.5 and 3.2). In his analysis he takes into account between five and 25 variables. He considered his results as suggestive only and worthy of further investigations. The other study was carried out by Boffetta. He found a higher mortality from lung cancer (RR 1.18) (confidence limits of 0.97–1.44) in railroad workers, heavy equipment operators and truck drivers. However, truck drivers exposed to diesel emissions were not at risk when compared with truck drivers without this exposure. Despite the large number studied, the RR is low and is no more than suggestive of an increased risk.

Conclusions

Extracts of diesel engine fumes were weakly carcinogenic when painted on mouse skin but much weaker (10-fold) than extracts of coke oven emissions which are carcinogenic to man. This finding is of limited value in evaluating risk to man because the method of exposure is very different from human exposure to diesel exhaust.

High concentrations of diesel exhaust were weakly carcinogenic by inhalation in rats but gross accumulation of carbon particles occurred in lungs and this is important when considering the carcinogenic process — more work is needed to show how important this overload is. No cancers developed in lungs which were not grossly overloaded.

Epidemiology studies are inconclusive and further studies are required to resolve the issue. The present information suggests that there may be a slightly higher evidence of lung tumours in people occupationally exposed to diesel exhaust. However, confounding factors do not allow a conclusion that the increased risks are attributable directly to exposure. If exposure to diesel emission does present a human cancer risk, this is extremely small, even in groups whose occupations involve higher exposure than the general population. ■

This paper will be published shortly in the proceedings of the IP Conference, 'Automotive and Industrial Fuel Combustion — Environmental and Health Implications.' Already available from the IP Library is 'Review of Literature on the Possible Carcinogenicity of Automotive Emissions' — a report to the IP by Professor Grasso et al, price £48.

Cost reduction offshore in Gulf of Mexico

The world's deepest oil and natural gas production platform came on stream last November. The Jolliet tension leg well platform was installed in 1,760 feet of water about 170 miles southwest of New Orleans in the Gulf of Mexico. This is part of the largest offshore project ever undertaken by Conoco, a subsidiary of Du Pont, although it already operates more than 140 platforms in the Gulf of Mexico.

Operator Conoco holds an equal share of Green Canyon Block 184 with OXY USA Inc, a subsidiary of Occidental Petroleum Corp, and Getty Oil Co, a subsidiary of Texaco Inc.

The innovative tension leg well platform (TWLP), unlike the usual platform, floats at the surface of the water and is connected to a foundation template on the seabed by vertical tubular steel mooring lines. The buoyancy of the platform creates an upward force, which keeps the legs under tension. This eliminates vertical motion and enables the platform to float in place. This concept means that there is no need for a rigid underwater support structure and helps to reduce costs.

In a little more than two and a half years, the project team completed the construction and installation of the TWLP, the central production platform (in 617 feet of water) and three major pipelines. It also drilled 20 wells and started production on schedule and within the original $411 million budget. Capacity of the Jolliet production facilities are 35,000 barrels of oil and 50 million cubic feet of natural gas daily.

Big challenge

Water depths also provided a challenge to pipe-laying. 'We were operating at the forefront of offshore pipeline technology,' said Bill Tillinghurst, project engineer on the Jolliet pipeline system. 'This was the limit with the equipment routinely available in the Gulf'.

The project involved the laying of steel pipe in 1,390 feet of water and the installation of flexible pipe to connect with the TWLP in 1,760 feet of water. Moreover, even with all the high-tech equipment, there was still a need for divers who were working at record depths in the Gulf of Mexico.

Cost reduction

The Jolliet TWLP concept has obvious cost-saving advantages. Including the legs and templates, it required only 12,000 tons of steel, whereas perhaps 80,000 tons would have been needed for a conventional rigid platform at the same water depth. With the TWLP, cost savings were possible in materials, fabrication and installation.

To achieve maximum cost efficiency for deep-water structural design, equipment on the platform was kept to a minimum — wellheads, the production separator, the well test system, a completion rig, a gas compression system and accommodation for 47 people.

The remaining equipment and accommodation was installed on the fixed central production platform in shallower water about 10 miles north of the TWLP in Green Canyon Block 52.

Conoco President and Chief Executive Officer Constantine S Nicandros, describing recent cost reduction measures, said, 'We have cut costs as much as possible . . We are now a very lean industry. Lower crude oil prices have changed the way we do business as a whole. But cost reductions can only take us so far. As evidenced by the Jolliet field, the formula for coping must rely heavily on technology'.

Conoco is so pleased with the Jolliet project that it plans more similar platforms, perhaps also in the Gulf of Mexico.

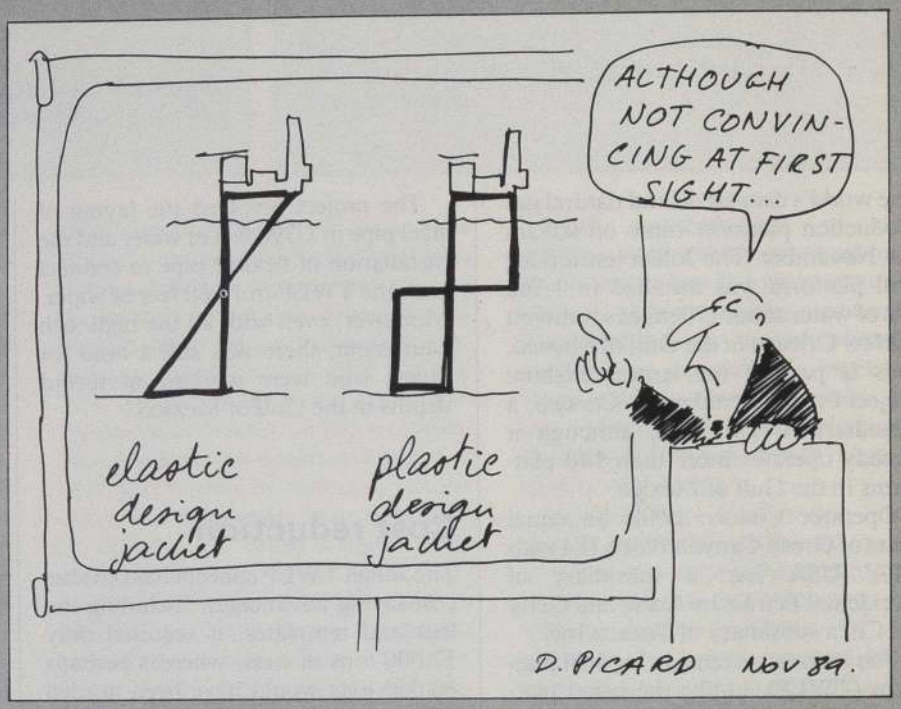
Pipelaying in the Gulf of Mexico.

IP CONFERENCE LOOKS AT COST REDUCTION IN THE NORTH SEA

On 16 November 1989, the Institute of Petroleum held a conference on the topical subject of 'Cost Reduction Offshore' — The Way Ahead'. The conference concentrated on recent developments and future prospects for the North Sea.

Mr M Woolveridge, Chief Executive, BP Engineering, in his keynote address, detailed the 'huge' improvements in cost savings, achieved in recent years and emphasised the 'small-is-beautiful' concept for fields now under development.

Subsequent speakers commented on three individual fields, limited state design, multiphase flow and subsea separation. Three of these papers are reproduced here, while the full proceedings, to be published shortly, will be available from the Institute of Petroleum.



Progress on Gannet

By JHT Carter, Project Manager, Gannet, Shell (UK) Exploration and Production

Shell/Esso's Gannet project is a new oil and gas development which has only recently been approved, although an Annex 'B' for the original Gannet development was submitted as long ago as 1985. The Gannet fields almost straddle the Fulmar to St Fergus gas line to the south east of Kittiwake, which is presently under development and due on stream in 1990.

Kittiwake itself has led the way in cost reduction terms, by taking advantage of the large capacity semi-submersible crane vessels (SSCV). It also has a lift installed jacket and a single integrated deck, rather than several modules requiring extensive hook-up. The Fulmar-St Fergus Line provides the obvious evacuation route for gas export. For oil export, having examined a number of options, we will be laying a new 110 km trunkline to Fulmar, to connect into the existing offshore storage and loading unit already located there.

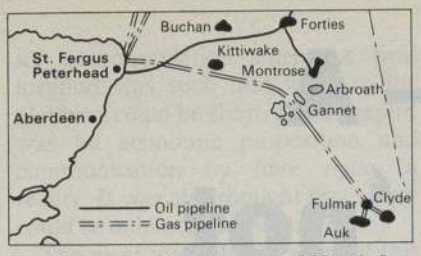
Gannet comprises four separate and distinct fields containing some 170 million barrels of oil, and 700 billion standard cubic feet of gas. The fields lie approximately 112 miles east of Aberdeen in a water depth of 95 metres.

High subsea content

The main innovative feature of the Gannet complex is a high subsea content, three of the fields being subsea satellites to the main platform on Gannet A. The second feature is that we shall be using tender assisted drilling, rather than the more conventional drilling unit integrated with the topsides of the platform. The third feature is the minimum facilities approach. This is something that we have been studying and developing over the last three years and on which Kittiwake has made the first steps. We have gone further and particularly addressed minimum manning for this development. The incorporation of tender assisted drilling and much reduced living quarters, has assured the deck and jacket will both be single lifts of some 9,000 tonnes.

The **figure** shows the Gannet field layout with the subsea wellheads and associated flowlines leading into the main platform. Fortunately for us, the Fulmar gas line already has a diverter in the vicinity of Gannet, which will provide the connection for gas export. We will be laying a new oil export line to Fulmar, following the route of the gasline. Gannet D has five subsea wellheads and a subsea manifold with four flowlines (2 bulk oil lines, one individual well test line and one common gas lift line), leading to the platform on A.

On Gannet B, our gas field, there are two wells and two lines to the platform. Gannet C is a more complex affair



The Gannet field in the central North Sea.

requiring four drilling centres with three subsea wells on each, and these are located on the periphery of the field, to tap best the rather steeply sloping reservoirs around the salt dome.

The wells on these four drilling centres, will be connected to the main platform by individual well flowlines and gaslift lines bundled into a carrier pipe, which will be constructed onshore and towed offshore using the mid-depth tow method. Two bundles containing 14 lines each, will connect the nearside drilling centres to Gannet A and two smaller bundles of eight lines each, will connect the furthest drilling centres to the larger bundles.

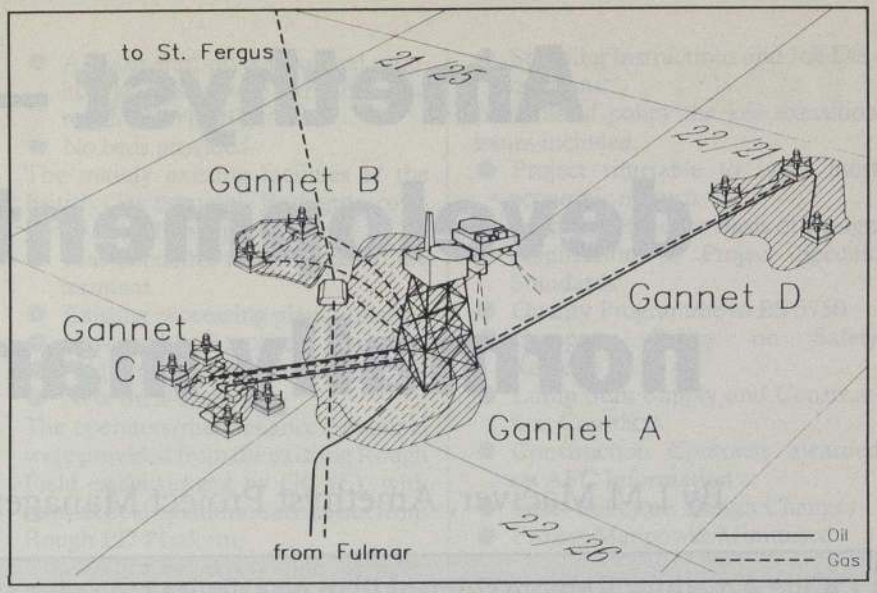
Jacket and topsides

The jacket has four legs, with six support points for the topsides which is heavier and longer but with fewer decks than the Kittiwake topsides. This is partly due to the number of subsea flowline risers (in addition to the well risers) on Gannet A, which the platform must support. We have spent a lot of effort in ensuring that this can be a lift installable jacket. Thus, we are able to save large amounts of steel which would normally be required for launch and upending.

Although tender assisted drilling (TAD) has already been used by Esso in the Norwegian sector, this is the first time it will be used in the UK sector. It will provide us with considerable savings on topsides weight, not just in equipment, but also in living quarters and all the associated life support systems required for larger living quarters.

Apart from the living quarters, derrick equipment set and flareboom, the topsides will be installed in one lift. This will provide us with savings over a modular platform in installation, hook-up and commissioning time and thereby, a reduction in the overall cost.

The old development included Kittiwake, and had four platforms with only one subsea satellite field. By comparison, the new Gannet area as it should be in 1992, will have only two platforms but three subsea satellite fields. The overall development costs today, are approximately half those first proposed for the overall Gannet development in pre-1986 oil crisis days.



The layout for the Gannet complex, showing a central platform (Gannet A) tied into three subsea developments (B-C-D).

Cost reduction

A number of areas have achieved cost savings in themselves but have also contributed to reducing manning levels and lower operating costs. These include the higher subsea content, minimising platform equipment, and the tender assisted drilling.

If we combine these principles with the concept of multi-skilled operating technicians, which allows the use of taskforce maintenance (a 19-strong team on the platform, some two weeks out of five), we can successfully reduce permanent platform manning and accommodation requirements. With better use of computers for monitoring process facilities, automation of routine operations and production start-up procedures, we come down to the requirement of only 40 beds for the Gannet living quarters. There has been a drive towards reducing our permanent offshore manning requirements because we feel strongly that this reduces risk and makes for safer offshore operations.

Cost reduction has been achieved through the minimum facilities approach on topsides. We have single train processes, and have minimised sparing, particularly where items have been proven to be extremely reliable, e.g., the use of single transformers. We intend to increase the use of stainless steel in our piping to reduce weight (in keeping with the liftable integrated deck concept) and to reduce the requirement for chemical injection. We will be making use of the substructure legs for tankage and pedestals in the topsides for bulk storage. These factors combined with the integrated deck design which reduces hook-up and commissioning, contribute to an overall reduction in the costs of our topsides facilities.

Finally, we have looked at reducing costs in carrying out the project by standardisation in materials, reducing project management costs and improving the management of our topsides fabrication. We have awarded design, fabrication and installation contracts at the same time. For the pipelines and jacket, this will be done using an EPIC approach but, for the topsides, the more traditional approach of using separate design, fabrication and installation contracts will be employed. These however, were awarded on the same day. The design contractor thus has the opportunity in designing not only for end use but also a unit which is cheaper to construct and install, by making use of the fabrication and installation contractors' input at the earliest stages of design.

There is no single general panacea for the reduction of costs offshore. We can only do this through a concerted and co-ordinated approach in many areas, so that the overall effect is then substantial and, in the case of Gannet, we feel that we have over the last few years halved the costs, so that not only is Gannet now feasible but other future 'marginals' can be made so. ■

Fields	Geological Trap	Hydrocarbons
A	Anticline & stratigraphic	Thin oil rim with gas cap
B	Pierced salt dome	Gas/condensate
C	Pierced salt dome	Oil with gas cap
D	Structural dome	Undersaturated oil

Features of the four Gannet fields.

Amethyst — A development 'not normally manned'

By LM Maciver, Amethyst Project Manager, BP Exploration

The Amethyst Remote Control Plan was devised to reduce the costs of developing smaller gas fields and to enhance the efficiency of such operations.
Its implementation in 1988 has resulted in:

- Significant capital cost reduction.
- Operating cost greatly reduced.
- Budget contingencies reduced as a result.
- Overall field management infrastructure greatly reduced.
- Plant automation enhanced.
- Communication more reliable.

The Amethyst field is located in the southern North Sea some 40 miles east of the Humber Estuary. The field was discovered in 1972, a UKCS first round licence.

From its outset, the development of the field was foreseen as an engineering challenge — in this regard there have been few disappointments. In 1983/84, the challenge was intensified with an expansion of appraisal drilling, by the Britoil partnership in 47/14a, and the Amoco partnership in neighbouring blocks. Early development studies were centred on the 47/14a block, where reservoir appraisal was more advanced. These studies yielded some interesting questions, but no tangible answers. However, steady progress was being made with reservoir appraisal.

In 1985 a small dedicated 'in-house' team was assembled with a specific remit to pursue aggressively a technical resolution and establish a development plan. This effort began to yield results. By 1986, the owners agreed a basis for unitisation. The larger Amethyst area was emerging, development options gathered pace — Amethyst began to be a reality. However, the development options being considered were not yielding the best results. Indeed, the team was still tied to 'current oil/gas field practice'; this was subsequently entitled 'the motherhood approach'.

It was clear that a new initiative was required. Technical excellence was a high priority. Application of 'innovative ideas' needed to be given full consideration. Transportation/processing options were narrowly evaluated. A new initiative was implemented.

We believe the Amethyst development story offers the industry both a 'cost reduction option' and 'a way ahead'.

Plan objectives

In early 1986, the development options, which had hitherto been under consideration were re-visited, and a more targetted approach with clear objectives was established.

This period of study lasted for some three months and brought together the in-house expertise of Exploration, Geophysicists, Reservoir Engineering, Facilities Engineering and Commercial on a common basis, to achieve a development solution featuring a number of key issues. Traditional development approaches were relinquished and field operating philosophies and current practices were reconsidered; innovative thinking was further encouraged. Capital and operating costs targets were set and reservoir behaviour studies were undertaken. Available landfall infrastructure was closely examined while transportation and processing options were given in-depth examination. In addition, the location of the field was studied for advantages; environmental and safety issues were critically examined; development options were given independent HAZAN evaluation; availability of 'on the shelf' technology and compression facilities were evaluated. Finally, a 'value for money' execution strategy was developed.

The plan's outcome

The study period yielded many interesting issues, each being given due consideration and accepted or rejected on merit. Some issues remained outstanding; nevertheless, a clear and concise view emerged, which was both encouraging and greatly increased confidence.

A critical examination of conceptual ideas had proved positive, with a multi-platform 'remote control' development a reality. The building blocks were virtually all tried and tested elements but the various transportation options required a solution. Capacity existed at various landfalls to process the gas while terminal owners could offer operating services. Compression could be installed onshore but this would not affect the reservoir recovery. Significant reductions looked a real proposition both in capital and operating costs and in maintenance, by eliminating rotating plant. In addition, on platform storage of fuel and other consumables could be eliminated, as could the need

for accommodation since the field location was such that visits to the platform could be short. Power export was an economic proposition and communication by fibre optic, a reality. It was also thought that safety could be enhanced significantly.

The most interesting feature of this work was that only a few issues created a major obstacle in confidence level, since many of the steps had, in some form been taken before, but not together, to develop a multi-platform field. Therefore, in mid-1986 the multi-platform remote controlled plan was born. After a thorough evaluation, it was proposed to Unit Partners as 'the way ahead'.

Agreement in principle was given to the scheme. Competitive tenders were sought from terminal owners for gas processing and condensate transportation; and operational services. The remote control scheme details were expanded and a Development Plan, Basis of Design and Execution Plan were all finalised.

The tendering exercise was undertaken by Enterprise Oil, on behalf of the Amethyst Partnership. After a full exchange of information with partners, their confidence was speedily achieved and, in June 1988, the multi-platform remote controlled development plan was approved by the partnership and the Department of Energy.

Specific features of the plan

The in-house prepared basis of design and specification for the offshore facilities, were converted into engineering documents for construction and operations. The onshore terminal facilities were specified and agreement reached with Gas Council (Exp) on the scope of facilities to be utilised and the services to be provided. The offshore facilities of the Amethyst field comprised four conventional steel jacketed structures having:

- No normally rotating plant
- No instrument air or plant air
- Systems hydraulically operated from conventional hydraulic panel
- Remote operated sphere launcher (A2D only)
- Field Control System — proprietary package
- Communication — digital line of sight with fibre optic infield
- Power exported from Easington — Grid supply
- Production Separator and Test Separator
- Plant type metering on each platform
- All post start-up control and monitoring from shore terminal and rough (BD) platform
- No beds provided.

The mainly existing facilities at the British Gas terminal, Easington comprised the following features:

- Master control room located at the terminal
- Existing processing plant utilised
- New methanol recovery plant
- Additional condensate storage
- New fiscal metering.

The operators/maintenance personnel were provided from the existing Rough Field establishment by GC (E), with normal field operation carried out from Rough BD Platform.

A dedicated export line between Easington and Immingham Export Jetty would allow condensate sale to the open market.

Project execution strategy

Innovative engineering solutions for developments will not, on their own, achieve the required cost effective outturn. A project execution strategy forms the cornerstone for cost effectiveness. On Amethyst, the execution strategy was given its due priority and prepared concurrently with the development plan.

The key strategic issues outlined were:

- Project Execution Philosophies and Policies
- Standards, Quality & Safety Programme
- Timetable and Targets
- Reviews and Audits
- Commercial and Financial Controls
- Contracting Strategy — Contractor Engagement
- Management Principles and Organisation
- Standing Instructions and Job Descriptions.

In terms of policy the key execution issues included:

- Project timetable to yield most economic outturn
- Strict adherence to Basis of Design
- Application of Project Specific Standards
- Quality Programme to BS 5750
- Company Policy on Safety Reviews
- Lump Sum Supply and Construction Contracts
- Construction Contracts awarded on AFC Information
- Strict Policy on Design Changes
- Project Manpower Minimised

Conclusions

In executing the project thus far, some conclusions are worthy of note. A strictly-applied effective project management strategy is vital to achieve a cost effective result. Cost reduction measures **must** be initiated at the conceptual stage. Though lump sum prices are meaningful design changes must be eliminated. The project management team can be small in size but must have an effective strategy; reservoir parameters need to be precise. It should be remembered that operating costs are largely determined at the conceptual stage, but are inextricably linked with capital costs.

Automation and remote control of plant and machinery can always be enhanced; in these terms, remote operation is very much a reality. Obviously, a reduction in plant and machinery offers significant operating cost reduction. Remote operation of a multi-platform field can be extended further offshore but remote operation, even in part, must improve efficiency. Finally, the contracting strategy must be realistic.

The programme took 18 months from the design stage in January 1988 to installation. After the supply and installation of pipelines, Phase 2 was initiated with drilling which began, according to plan, on 1 September last year. ■

The Amethyst Field Development Unit partners are:

BP Exploration (Field Operator)
Gas Council (Exploration (Services Operator))
Enterprise Oil plc
Amoco (UK) Exploration Co
Amerada Hess Limited
Ocean Exploration Co Ltd
Murphy Petroleum Ltd
Arco British Ltd
Texas Eastern (UK) Ltd
Fina Petroleum Development

The author would like to thank BP Exploration and the Amethyst Unit Partners for permission to publish this paper. The author would also like to thank all partners, project team members, BP Exploration staff and contractors, past and present, for their major contributions to the success of the development, thus far making the preparation of this paper possible.

Tender assisted drilling — the Odin field

By John K Smistad, Odin Production Manager, Esso Norge

Tender supported drilling on the Odin Field was the first to be successfully conducted in the North Sea. From August 1983 to February 1985 the Tender Support Vessel (TSV) *Treasure Hunter* supported the Odin platform hook-up, commissioning and drilling. TSV disconnect time and lost drilling time was shown to be significantly lower than predicted during the design phase.

Eleven gas wells were drilled and completed from the start in mid-December 1983 till February 1985. Besides having additional living quarter capacity, the TSV provided mud storage, mud pumps and mud treatment, a cementing unit, cement bulk storage, laydown area and other services during the drilling operations. During the hook-up and commissioning period, the TSV provided necessary accommodation for the hook-up team as well as fabrication and warehouse facilities.

The Odin field

Odin is a gas field in the North Sea located approximately 178 kms from Bergen and 240 kms from Stavanger.

The licence was awarded to Esso in 1969 and the field discovered in 1973 in 103 metres of water. The licence is operated and wholly held by Esso as one of the very few in the Norwegian sector with 17.5 percent net profit interest to the government through Statoil.

Initial evaluation of the Odin reserves, indicated that a fully integrated DPP Platform (Drilling Production Processing) could not be justified due to limited reserves. Further studies showed that Odin could be developed using surplus capacity on the TCP2 (Treatment Compression Platform) on the Frigg gas field located approximately 26 kms south of Odin. The Frigg field was being developed by the Petronord Group with Elf Aquitaine Norway. It was important to minimise platform size and capital investment in the development of Odin and three factors had to be taken into account:

- Availability of space and spare processing capacity at one of the Frigg platforms;
- The low numbers of wells to be drilled (11);
- The short drilling period (14 months).

Figure 1 shows the Odin-Frigg arrangement. A 26.5 km 20 inch pipeline transports Odin gas to the TCP2 on Frigg, where processing, metering and compression is done before shipment of the gas to St Fergus in Scotland, via the MCP1 (Manifold Compression Platform). On Odin, the produced gas is treated in a first stage separator, where water and condensate is knocked out. The condensate is dumped back into the gas stream, leaving the platform to TCP2, and the produced water is treated and discharged to the sea.

Study of marginal field alternatives, including subsea development, identified a tender support concept as the most viable option. Tender supported drilling operations had not been conducted in the North Sea before, but the concept had been applied in the Gulf of Mexico for many years, particularly through the use of cantilever jack-up rigs up to medium water depths.

The use of a TSV meant that the equipment requirements for a fully integrated platform could be shifted onto the support vessel. These equipment items were mud pumps, mud pits, cementing unit, mud and cement bulk tanks.

To ensure platform safety during periods when the TSV was disconnected, or during severe weather conditions, the platform is equipped with a cement pump unit, some bulk material storage and mud pits. The effect of having the major equipment on the TSV, reduced the size of the jacket from an eight-leg design to the four-leg concept as built. The reduction in capital investments made it possible to develop the field economically, although drilling costs increased for the 14 month period the TSV was used to support drilling operations.

Tender support system

The Odin tender support system consisted of two major components: the TSV and a gangway/bridge.

The TSV provided equipment and facilities and the gangway provided the connection between the TSV and the Odin platform for the supply of services. The TSV *Treasure Hunter* was an Aker H-3 semisubmersible, built in 1975 and modified in 1983, to meet Esso's need for the Odin operation, as well as the Norwegian Maritime Directorate and Norwegian Petroleum Directorate standards and regulations.

The vessel was used for several years prior to being contracted by Esso, as an accommodation vessel (flotel) in the Brent field in the UK sector and had no drilling equipment onboard. The equipment was installed in the first half of 1983 and the vessel's stability, mooring and safety systems were upgraded. The modifications undertaken were particularly influenced by new regulations imposed following the tragic *Alexander Kielland* accident in the Ekofisk area in March, 1980.

The installation of new accommodation, mud pits, pumps, mud treatment

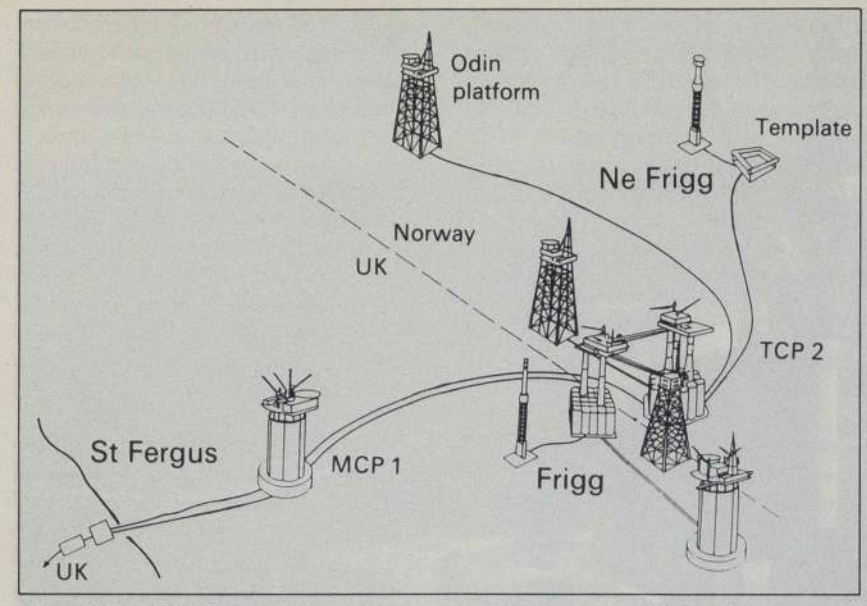


Figure 1: The Odin-Frigg system.

and cementing unit required new stability calculations. The equipment was selected with the aim of standardising and minimising spare parts and easing maintenance on both systems.

The TSV mooring system was an important part of the tender support operation, since the vessel was to be essential in conducting drilling/completion operations. It was not as necessary for an accommodation vessel to remain physically connected to the platform as for a TSV, since helicopter shuttling of personnel can be accomplished with only a small delay.

TSV mooring

The mooring system was designed to keep the TSV alongside the Odin platform during wind speeds of 26.6 m/sec (50 knots), a sea water current of 1 m/sec and wave heights of 10.7 m.

Oil Rig Quality (ORQ) anchor chains were replaced with stronger K4 grade anchor chains to minimise the risk of the TSV colliding with the platform during the extreme weather conditions of the North Sea. The TSV mooring configuration consisted of eight anchors. A ninth anchor was placed opposite the platform to increase further the safety of the mooring system and to avoid the TSV blowing towards the platform.

The new stability requirements established for accommodation vessels imposed by the Norwegian Petroleum Directorate, made it necessary to add four 3.8 metre diameter sponsoons to the vessel. This was as a result of numerous calculations and tests in laboratories (**Figure 2**). The purpose of the sponsoons was to improve buoyancy and reduce heeling angles during emergencies which could be caused by major structural damage to the vessel.

Other upgrading of the vessel included Harding lifeboats, life rafts, life buoys, life jackets and survival suits. The TSV was equipped with a new 40 tonne Liebherr crane, with a 47 m boom on the side of the TSV closest to the platform, to allow transfer of pipe and other materials to and from the platform pipe rack.

An additional living quarter block was added to the TSV and the existing quarters were modified to meet the new regulations. The two quarters together could house 140 persons. Together with the 48-man living quarter on the Odin platform, the accommodation capacity was sufficient for all the personnel involved in hook-up, commissioning and drilling operations.

Gangway

The gangway provided the physical connection between the TSV and the platform. The gangway was 30 m long with a total weight of 36 tonnes and contained fluid piping and electrical conduits. Each platform supported itself with high voltage power and, therefore, no high voltage cables were running across the gangway. The gangway was also provided with electrical lighting, a shielded roof to reduce radiation heat in case of a major fire and a sprinkler system for cooling purposes, in case of evacuation from the platform over the TSV. The gangway was fixed to the platform with a gimballed connection.

The electro-hydraulic gangway lifting system with a back-up hydraulic package was located on the Odin platform. The system included motion compensation (constant tension), since the gangway was defined as a lifting system similar to a crane. A trolley at the end of the gangway on the TSV side moved on a landing platform built onto the TSV.

The gangway trolley was connected to a hose trolley, which supported the flexible hose connections between the gangway and the TSV fixed piping. The hose trolley was moving along a fixed track parallel to the gangway and allowed flexible hoses to be connected to the fixed piping on the gangway. On the platform side, flexible hoses were used from the gangway fixed piping and connected to the platform piping. The hoses were fitted with an emergency break-away coupling on the TSV side. These couplings were weak links located at the end of the flexible hoses on the TSV, to minimise damage

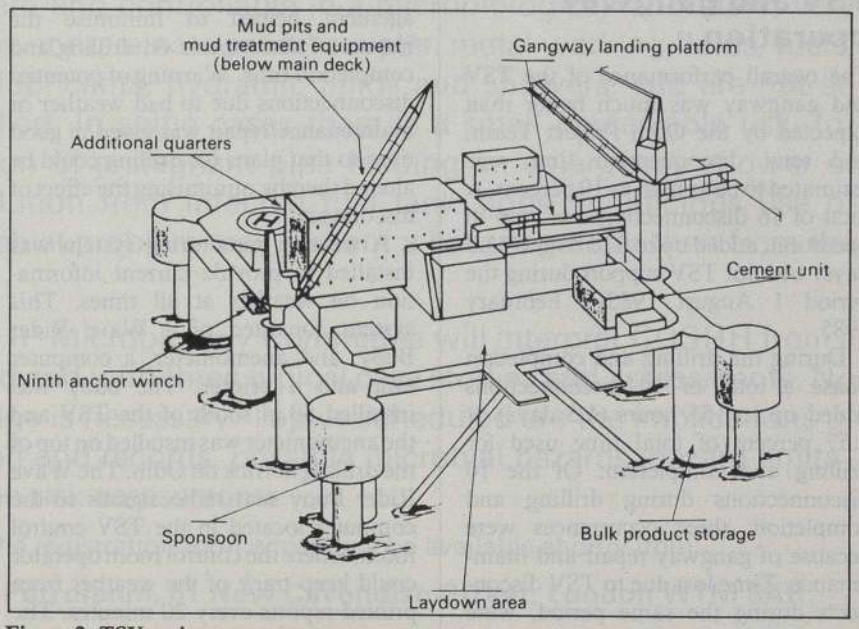


Figure 2: TSV major components.

The Odin platform.

in case an emergency disconnection should be necessary.

The high pressure hoses were kelly hoses and the low pressure hoses were standard LP services hoses. Redundancy was important to ensure having one line always operable in case of leaks, washouts and other problems with the lines. A spare gangway was also built as an insurance measure in case a storm or a lifting operation damaged the gangway. It would normally take only 2-3 days to change out the gangway.

TSV and gangway operation

The overall performance of the TSV and gangway was much better than expected by the Odin Project Team, and total disconnection time was estimated to be as high as 10 percent. A total of 16 disconnections, or stop in operation, added up to 328 hours (13.6 days) without TSV support during the period 1 August 1983–9 February 1985.

During the drilling and completion phase a total of 10 disconnections added up to 155 hours (6.5 days) or 1.57 percent of total time used for drilling and completion. Of the 10 disconnections during drilling and completion, three occurrences were because of gangway repair and maintenance. Time lost due to TSV disconnects during the same period, were only 43.5 hours or 0.44 percent of the total drilling and completion time. Also, the actual lost time was significantly lower than the disconnected time because other operations could continue during these periods (ie testing, logging or completion work). Lost time due to bad weather was 1.34 percent or three times as much as the lost time due to TSV disconnections.

One factor which also contributed to the low disconnect time, was the experience of the TSV crew which had operated the vessel for several years as an accommodation vessel in the UK sector. Good cooperation between the TSV crew and Odin platform management helped to minimise the impact of disconnects on drilling and completion time. Warning of potential disconnections due to bad weather or maintenance/repair was given in good time so that plans for drilling could be altered thereby minimising the effect of disconnect.

A weather monitoring system was installed to provide current information on weather at all times. This system consisted of a Wave Rider Buoy, and anemometer, a computer unit and a printer. The buoy was installed 50 m south of the TSV and the anemometer was installed on top of the drilling derrick on Odin. The Wave Rider Buoy sent radio signals to the computer located in the TSV control room, where the control room operator could keep track of the weather from printed reports every 20 minutes. The most significant data recorded were wave height, wave period, wind speed and wind direction.

It is difficult to quantify the amount of additional time alongside the platform that was gained by having the weather monitoring system installed, but it clearly made it possible for TSV and Odin platform management to plan the overall operations much better.

Gangway design

Several gangway design features were found to be unsatisfactory. A ball joint accommodated the motion between the gangway and the trolley on the TSV and this design was found to be very effective, requiring only occasional lubrication. The load exerted on the wheel bearings on the trolley exceeded by far the design values, primarily because of the complex movements of the TSV due to the addition of the sponsoons and the heavy acceleration of the trolley during storm conditions. Modifications were therefore performed to the wheel bearings and to the load bearing areas. These modifications were only partly successful and led to the conclusion that similar gangways in the future would need higher load carrying design.

The motion compensation system (constant tension) was designed to keep the gangway lift wire stretched during all TSV motion situations. Due to the sharp and rapid movements of the gangway, the hydraulic cylinder

was damaged and had to be replaced. The motion compensation system was disconnected and used only during severe weather conditions or when the system was in standby, prior to a lifting/disconnect operation.

The gimbal part of the gangway was attached to the Odin platform with a centre core. The large forces acting on the centre core, wheels and bearings resulted in reinforcement of the gimbal. The large forces acting on gimbal centre were a result of the 10° slope of the gangway down towards the TSV.

Problems were also experienced during connection operations of the gangway with the trolley onto the TSV landing platform, without causing damage to the trolley. Two air tuggers located on the Odin platform with guide wires to the gangway were used to position the gangway over the landing platform, prior to setting the gangway down on the TSV. Rapid sideway movements, as well as a circular movement pattern of the TSV, caused problems in positioning the gangway over the TSV.

The flexible hose disconnect system at the gangway trolley would be handled differently in another tender supported operation. The system utilised on Odin was regular hammer unions and this worked very well during good weather conditions when the relative movement between the TSV and the trolley was low. However, during heavy seas and high winds, the relative motion between the gangway and the TSV made breaking the hammer unions with a sledge hammer a difficult and sometimes dangerous task. Therefore, to ensure that safe procedures were followed, the hoses were disconnected prior to the weather being severe enough to cause disconnection of the TSV.

Safety

No personal injury or material damage was experienced when the TSV was used to support Odin hook-up, commissioning and drilling operations. Safety analysis showed that the TSV was an additional safety measure for evacuation of personnel, in case of, for instance, a blow-out during drilling.

A card board tracking system was located on each side of the gangway to keep track of each person working in the field on Odin or on TSV. Emergency exercises were conducted regularly, to monitor the effectiveness of evacuation to the TSV and use of the card board tracking system. The operation was conducted in a safe and reliable manner and disconnection criteria as described earlier were concluded to be conservative.

Conclusion

The use of a tender support system for drilling operations has proved to be useful in minimising the capital costs of developing marginal North Sea oil and gas fields.

The Odin gas field has to date produced approximately 50 percent of the estimated recoverable gas reserves of 34.5 billion cubic metres without any significant problems. The simplicity of the Odin platform design has proved to be effective with regard to operational availability and maintenance. Current manning levels, average 20–22 people, including contractors.

Economic analysis has, of course, to take into consideration factors such as vessel charter rates and terms, number of wells to be drilled, tender support performance and weather conditions. The operational problems with the Odin tender-supported drilling operations were minimal and the overall performance exceeded the expectations. ■

The author wishes to thank EL Smith and WP Dixon (Esso Norge as) for permission to use work previously done on this topic during the drilling phase of the Odin project.

Pierre Moussel, Managing Director of Elf Aquitaine UK, talks to *Petroleum Review*

Elf Aquitaine commits £800 million to UK North Sea

Pierre Moussel is the Managing Director of Elf Aquitaine UK, the British subsidiary of the French Elf Aquitaine group, based in Paris. Elf Aquitaine has spent over £800 million on the expansion of its oil and gas operations, chiefly through acquisitions in the UK sector of the North Sea, in the past 18 months.

In an interview with *Petroleum Review*, in which he discusses Elf Aquitaine's 25 years of experience offshore and onshore in the United Kingdom, Pierre Moussel said:

- **Elf Aquitaine UK, with a North Sea production moving towards a 50-50 balance between oil and gas, will be more active as it explores its six blocks from the 11th offshore round.**
- **Elf UK is investing £500 million as a partner in the development of the Bruce field — the largest undeveloped gas field in the North Sea.**
- **The company has a strong interest in deep subsea production for the future and, in addition to aiding BP in the diverless subsea production project (DISPS) with work and finance, is supporting research at the Cranfield Institute of Technology.**
- **Elf Aquitaine UK is stimulating a revival of interest in the large field known as Clair, west of Shetland, and a reappraisal by the partners towards means of getting out the heavy crude oil will start in the spring.**
- **In onshore exploration there is no parallel between the Paris basin, where there has been much activity, and southern England, although geologically they are the same.**
- **Elf Aquitaine has two main poles in its production strategy: Europe and Africa. In the European pole the lead in petroleum offshore is passing to the UK, with Norway and the Netherlands following. 'We are keen to continue our work in the UK where, generally, there is some pragmatism in the way the business is conducted and monitored by the authorities.'**

Geoffrey Mayhew: Elf Aquitaine UK is making strong developments currently in the North Sea but what brought Elf to Britain 25 years ago?

Pierre Moussel: To start with, there were two things. Firstly, we had a block in the UK which was very close to shore in the Scarborough area. It was offshore and an immediate continuation from onshore. We had a piece of land and sea.

Secondly, there was the opening of the whole North Sea by the UK, Norway, the Netherlands, Germany and Denmark. At that time, there was an arrangement under the Geneva Convention to set the border limits between the UK, Norway and the Netherlands. The move was the result of discoveries in the Netherlands.

It was the Groningen field which supported the idea that what existed in the Netherlands should exist off Scarborough as well. For this reason, the beginning in the North Sea was in the south, offshore Netherlands and the Southern Gas Basin in the UK sector.

The movement towards the UK was, at first, a movement towards the North Sea. Going to the UK was a consequence of a strategic decision to follow the flock of companies going into the North Sea.

Pierre Moussel.

Were other companies doing the same thing?
At the time Elf and Aquitaine were two separate companies and an association was formed with Total in the UK, Norway and Netherlands. It was decided that each of the three companies would have a one-third share in the association and one operating role in each country.

Now that Elf and Aquitaine are merged, we have a two-thirds interest in our associations with Total. We also have two operatorships, one in Norway and one in the Netherlands, with Total being the operator here in the UK.

Does France have a particular necessity to find oil outside its home territory?
France is not really an oil-producing country. A lot of people have said that the Paris Basin would become a new Texas, but that is ludicrous. There is a huge gas field at Lacq in the south of France; the initial reserves were something like 250 billion cubic metres, so Lacq, even on a world scale, is a giant. A few other fields have been found, like Meillon for example.

There was a good discovery by Esso at Parentis in the Aquitaine Basin in 1954; at that time it was producing 40,000 barrels per day. That field is now in decline. There have also been some satellite discoveries. However, if we are talking of production in the Paris Basin, a lot of small oil reservoirs have been discovered, but practically no gas has been found there. There is some small oil production.

Consumption in France is some 80 million tonnes per year; maximum production is 3 million tonnes, which represents some 4 percent, more or less, of what is actually consumed. Production cannot increase much more. Therefore, France needed to build up an oil industry overseas. As far as gas is concerned, Lacq at the beginning, some 30 years ago, represented 100 percent of consumption; now as it declines, it represents only 10–15 percent.

Has that necessity affected Elf's approach to the North Sea sector?
We can look at our position in the North Sea only in the perspective of group exploration and production strategy, which is based on the idea that there are two main poles. One is centred on Europe, especially northern Europe, including France to a certain extent. The other is centred on West Africa, which accounts for the bulk of our production. We are producing in five countries: Gabon, Cameroon, Congo, Angola and Nigeria. We are producing altogether more than 250,000 barrels a day.

As far as northern Europe is concerned, with the development of the Frigg field, the leading role in that area went to Norway; now the leading role is rather more with the United Kingdom. However, Norway remains large as far as manpower is concerned; staff numbers were built up for Frigg, which is now in decline.

During the following 25 years, your investment has grown from a very small amount to an enormous sum.
That's true. At the end of 1988, we had invested about £2 billion in exploration and development, which includes over £1 billion for Alwyn North and £700 million for Frigg. In 1990, we will spend £42 million on exploration and Elf UK's investment in the Bruce project will amount to £500 million.

Does that include recent acquisitions?
No, in 1988 we did two things. First, Elf Aquitaine purchased the oil and gas interests of RTZ for £308 million. As is now very well known, companies have a policy of concentrating on their core business. RTZ said, 'We are a mining company. We had a cement company and sold it. We have oil and gas interests, and we are going to sell them to concentrate on our core business.' They then purchased BP Minerals which has increased their mineral resources.

In one simple transaction, we purchased RTZ's oil and gas and associated companies forming their oil and gas branch. We did so because it complemented very well our existing acreage offshore in this country. Elf UK has share interests in many blocks, and we have been increasing our presence in areas, such as the Bruce field and what is now called the Franklin field, in the south.

Where we cannot get in, we try to obtain acreage from the Rounds of Offshore Licensing. Or we can farm-in. But we can only buy a share from somebody else if they want to sell. Thirdly, we can swap acreage with other companies. Finally, we can purchase a company with good acreage. What we had been doing was trying to extend our activity in this country through the first three methods.

But we thought the process was too limited and too slow, so we decided to catch up rapidly by purchasing, in one operation, some good acreage, which was what we did with RTZ. Our

second major transaction in 1988 was to purchase for £368 million a 25.2 percent interest in Enterprise Oil; a completely different exercise. We are now the largest shareholder, with ICI holding a 24.8 percent share.

We made that investment in December of 1988. You will remember that Lasmo, which had a holding of 25.2 percent in Enterprise, decided to sell and at the end of the day we found we could purchase it at a good price. When you look at the quotation on the stock market you will see that what we did was sensible. We have no control over the policies of Enterprise.

Generally, was it their gas prospects which attracted you most?
Recalling what I said about the Lacq discovery, we have always been very keen on gas. At the beginning of the 1980s, worldwide production for the group was half gas and half oil. In this country production has mainly been gas, because of Frigg (UK), our largest field which lies on the border with Norway; roughly 60 percent of the reserves are in Norwegian waters and 40 percent in UK waters. Elf UK owns two-thirds of the 40 percent. First production from Frigg was on 16 September 1977.

In this country, we were first of all a large gas-producing company. The Alwyn North field which began production at the end of 1987 is half oil and half gas, roughly speaking, so we are now producing good quantities of oil. On top of that, we have 3 percent of Forties, which is operated by BP; 3 percent of a huge field is worthwhile. In addition, we are producing some oil from smaller fields acquired from RTZ.

So, at group level, the half-and-half situation at the beginning of the 1980s is becoming more generally two-thirds oil and one-third gas. In the UK, it is becoming half-and-half, having been at the beginning all gas and no oil. We have no special strategy as far as that is concerned. If we discover hydrocarbons we are glad. If it is oil, we treat it as oil; if it is gas we try to do it the gas way.

My prognosis or forecast is that, in future, in the UK there will be more gas than oil discoveries. As we plan to be more active in exploration, we are very likely to discover more gas than oil.

Can one judge whether gas will be more profitable than oil?
Gas disposal is always more difficult than oil disposal. In general, gas production is more difficult than oil. The problem comes when you have the gas at one place and the consumer at another. You have the problem of transporting and selling it, which is generally a very complicated, costly and lengthy process.

Usually, it costs more to produce gas; and the odds are that the economics of an oilfield are better than those of a gas field. You have to remain very general in this statement because you can find places where you can make an awful lot of money out of gas and other places where oil will not be very profitable.

Generally, the transportation of gas is rigid because the gas from the field is carried by pipe to the consumer, whereas oil can be put onto a ship and be taken anywhere in the world. This means you would never develop a gas field without having pre-sold the gas.

We took the decision to develop the Bruce field because, on 24th August, we agreed to sell 90 percent of the gas to British Gas.

In the 11th Round you obtained licences for some interesting blocks.
We got six blocks, three as an operator and three as a partner. As far as the ones we are to operate are concerned, there is one block — the two others might also be associated with it — where we are tackling deep, difficult and high pressure prospects, but not in especially deep water.

We are rightly considered to have very good knowledge about working in difficult and rough seas, and we have developed some very good techniques, especially for use in Norway and also Africa for subsea production; some of these techniques will be used in Alwyn South when it is developed.

As a company, does Elf have an interest in deep water production?
The so-called Skuld system which we use in the East Frigg field in Norway, is a system which has been developed and designed by the group. We have tried to be at the helm of this and I think we have been reasonably successful.

You are associated with BP and their deep water projects.
Yes. We are associated with BP in three ways. One obvious way is that we pay about 40 percent of the total cost of the Diverless Subsea Production System (DISPS) programme that BP has set up. Within DISPS there is a part where we have a special interest, which is the remote guided vehicle (RGV), so we finance its development.

I said there were three ways in which we are involved with BP. Firstly, we have put money into it. Secondly, we have put one man who is specially oriented to the RGV into the BP team. Thirdly, in our laboratories at Pau and Boussens in France, we are studying a special part of the RGV.

And you are funding research into subsea matters at Cranfield.
Yes. When we inaugurated the Alwyn North field in April 1988, in the presence of HRH The Prince of Wales, we said we would make a grant of £500,000 to Cranfield for the establishment of a subsea technology research laboratory. This group at Cranfield will continue to research into precise points of technology for offshore and especially, as you have mentioned, deep offshore.

Do you think the very deep will be exploited around the UK before the year 2000?
I can tell you one thing. There is no really deep water in the UK, except in West Shetland and I do not think West Shetland and Rockall will be in full production before the end of the century, because there will be no need.

Elf has one field west of Shetland — Clair?
Yes. We have 25 percent of one of the licences which comprise the Clair field. We are operating on only a narrow piece and there are many problems. One problem is the location. This field is in a very difficult location; it is very remote from the consumption areas. The seas and climate are rough. The accumulation is certainly huge; the quantity of hydrocarbons trapped there is very large, but at sea, you need to have the unit production per well above a certain level for it to be economic.

Therefore, the reservoir is apparently of rather bad quality, or bad quality, and if the individual wells produce only 100 barrels a day, you cannot make economic production out of it. What we have proposed is to drill one experimental horizontal well. Without going into detail, a horizontally-drilled well can drain a difficult reservoir more easily than a vertical one. We are working with BP and other partners on a seismic survey to reappraise the area.

If your partners did agree, could one see horizontal drilling at Clair in the next year or two?
I do not know. We are very wisely doing this seismic campaign jointly

The Alwyn North field, in the northern North Sea.

with BP and Esso, and when we have the results of the campaign next spring, we will make a decision. As a matter of fact, the Department has asked all the partners not to work separately but to try to pool their efforts, and we have been very willing to do so.

Could one draw some kind of parallel between onshore France — the Paris Basin — and onshore UK?
To a certain extent, yes, given the fact that, geologically speaking, the so-called London Basin and Paris Basin and the channel in between are one unit. So, there is no reason why things which are produced in the Paris Basin should not be produced in the UK and reciprocally. Apparently, it is more difficult than that, which I have learned at my own expense — for example, the British have found Wytch Farm. We are still looking for a French Wytch Farm.

Any knowledge we might have, and we do have it, of the geology of the Paris Basin has not been of great help to us, and certainly it has been of less help than we would have thought at first glance. That is the first point. Secondly, except for Crosby Warren, in general we have not been an operator onshore. We have been associated with Amoco and BP. Onshore, we have really been passive partners.

How do you find the petrol retailing business in the UK?
Difficult! As far as retailing is concerned, there is one thing which is better in the UK than France. There is no big competition from the supermarkets. In France the supermarkets are now selling 40 percent or more of the petrol. Growth in France has been very limited for many years, as in most western countries. Whenever there is an increase in the consumption of petrol, most of it, if not all, is taken up by the supermarkets.

In this country, the supermarkets represent some 5–7 percent, according to what I am told, so the situation is different and also better for the oil companies from this point of view. As far as we are concerned we have some 2.5 percent of the market, which is not very large. We have no refining and our marketing in this country is very closely linked to what we are doing in France and Benelux. There, we have agreements for the exchange of products and crude between ourselves and some of our competitors. Therefore, as far as the availability of required products is concerned, having no refinery presents no problems.

Do you wish to continue with petrol retailing?
Yes. We also sell lubricants and do very well. On the subject of lubricants, which interests this and other countries in our group, we have an organisation called Elflub. It is a kind of worldwide confederation of people in many countries, including America and the Far East, who sell our lubricants, or have agreements to carry out blending. This is a very active, competitive market worldwide in which we occupy a very good position.

Does your relationship with the international parent group help in marketing and technology?
Yes, because as far as the norms of the products are concerned, they are supplied either by our company in France or indirectly, in the sense that we get them by swaps with other foreign or British companies. As far as supply is concerned, the help given by the refining branch of Elf France is very important.

With regard to technology, the lubricants, which are always products at the forefront of technology, are group lubricants; they have been developed and produced by the group. As to the style of the service stations, for example, in France we have developed a special look which is called 'Star'. Changing the look of a service station can increase sales. That is what we have done in France, and we see it also in this country. The 'Star' image developed in France, despite the English name, has been introduced into this country.

Is Elf Aquitaine UK autonomous in exploration and production?
I think you use the right term: autonomous but not independent, naturally. As far as the way we handle operations in this country and our policy on exploration and production is concerned, we make our own decisions, according to group strategy.

Might or might not, international problems make you keener to develop in the United Kingdom?
I have already mentioned that for the oil group, even if we are also in chemicals, pharmaceuticals and cosmetics, there are two poles.

The North Sea is straightforward, and if there is anything we can do to reinforce our presence and activity in the North Sea, we will do it. In this respect, the UK is very important for several reasons. For example, despite the high degree of activity which we see in exploration and production in the North Sea, we are very confident that, provided the price of oil remains reasonable and around today's levels, there is still a lot to find — though probably smaller than Brent, and Forties but nonetheless, interesting.

In addition, for a subsidiary of an international group, the UK is a place where it can work. The government has a lot of power and authority, but I think it is using that power and authority carefully and honestly. ■

FORTHCOMING EVENTS

JANUARY

4th-6th
New Delhi: IAEE — 12th International Conference. Details: Dr RK Pachauri, Director, Tata Energy Research Institute, 7 Jor Bagh, New Delhi 110003. Tel: 619205, 618803.

14th-18th
New Orleans: '13th Energy-sources Technology Conference & Exhibition'. Details: Frank Demarest, ASME, PO Box 59489, Dallas, Texas USA 75229. Tel: (214) 746 4901.

15th-18th
Cranfield: Course on 'Aircraft Gas Turbine Fuel Pumping Systems'. Details: The Course Administrator, Short Course Unit, School of Mechanical Engineering, Cranfield Institute of Technology, Bedford MK43 0AL. Tel: (0234) 752766. Fax: (0234) 750728.

17th
London: Seminar on 'A Single European Energy Market in the Age of Environmental Awareness'. Details: Elaine Hendry, Legal Studies & Services Ltd, Bath House, 56 Holborn Viaduct, London EC1A 2EX. Tel: (01) 236 4080.

18th
London: Lecture on 'Abandonment of Offshore Pipelines' by MW Cooper, John Brown Engineers & Constructors Ltd. Details: The Pipelines Industries Guild, 17 Grosvenor Crescent, London SW1X 7ES. Tel: (01) 235 7938.

22nd-23rd
London: Course on 'North Sea Risk Analysis'. Details: DCA Consultants Ltd, Rosewall Cottage, Main Road, Aberuthven, Perthshire, PH3 1HB. Tel: (0764) 63936.

23rd-24th
London: Conference on 'Safety in Offshore Drilling – The Role of Shallow Gas Surveys'. Details: Jean Pritchard, Conference Organiser, Society for Underwater Technology, 76 Mark Lane, London EC3R 7JN. Tel: (01) 481 0750. Fax: (01) 481 4001.

29th-2nd February
Oxford: Course on 'Process Facilities for Handling Oil and Natural Gas'. Details: The Registrar, The College of Petroleum Studies, Administrative Offices, Sun Alliance House, New Inn Hall Street, Oxford OX1 2QD. Tel: (0865) 205521. Fax: (0865) 791474.

Call for Papers

The Society of Petroleum Engineers is holding the seventh European Petroleum Conference, EUROPEC 90, between 22 and 24 October 1990 in the Hague.

The organisers invite abstracts of papers for the conference before 23 February 1990. Preliminary topic papers for the conference include: reservoir characterisation; reservoir management; horizontal well technology; case histories; well technology; measures to stimulate marginal field development; innovative techniques; abandonment; economics and evaluation; environmental consequences.

Further information is available from:

Lesley Ann Sandbach
Programme Co-ordinator
Society of Petroleum Engineers
55/59 Fife Road
Kingston upon Thames
Surrey KT1A 1TA
Tel: (01) 541 5008. Fax: (01) 541 5657.

FEBRUARY

5th-8th
Cranfield: Course on 'Mass Flow Measurement'. Details: The Short Course Unit, School of Mechanical Engineering, Cranfield Institute of Technology, Bedford MK34 0AL. Tel: (0234) 752766. Fax: (0234) 750728.

6th-8th
London: Forecourt Retailing and Equipment Exhibition. Details: MGB Exhibitions Ltd, Marlowe House, 109 Station Road, Sidcup, Kent DA15 7ET. Tel: (01) 302 8585

6th-8th
Esher: Conference and Exhibition on 'Health and Safety at Work'. Details: Paramount Exhibitions and Conferences, Paramount House, 17-21 Shenley Road, Borehamwood, Herts WD6 1RT. Tel: (01) 207 5599. Fax: (01) 207 2598.

8th-9th
Paris: Conference on 'Offshore Pipeline Technology'. Details: Nadia Ellis, IBC Technical Services Limited, IBC House, Canada Road Industrial Estate, Byfleet, Surrey KT14 7JL. Tel: (01) 236 4080.

12th-13th
Singapore: Conference on 'Commercial Aviation in the Asia-Pacific Region to the End of the Century and Beyond'. Details: Financial Times Conference Organisation, Commercial Aviation in the Asia-Pacific Region, 126 Jermyn Street, London SW1Y 4UJ. Tel: (01) 925 2323. Fax: (01) 925 2125.

13th-15th
London: Course on 'Introduction to Petroleum Exploration for Non-Geologists'. Details: JAPEC Secretary, c/o The Geological Society, Burlington House, Piccadilly, London W1V 0JU. Tel: (01) 434 9944. Fax: (01) 439 8975.

15th
London: Lecture on 'Emergency Shutdown Facilities for New & Operating Pipelines' by Dr RK Jain, Brown & Root Vickers Ltd. Details: The Pipelines Industries Guild, 17 Grosvenor Crescent, London SW1X 7ES. Tel: (01) 235 7938.

19th

London: Conference on 'New Opportunities for Fuel Oil in Power Generation'. Details: Miss Susan Ashton, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Tel: (01) 636 1004. Fax: (01) 255 1472.

19th-23rd
Aberdeen: Course on 'Petroleum Exploration and Development Economics'. Details: DCA Consultants Ltd, Rosewall Cottage, Main Road, Aberuthven, Perthshire PH3 1HB. Tel: (0764) 63936.

19th-23rd
Oxford: Course on 'Prospect Evaluation and Reservoir Appraisal for Development Planning'. Details: The Registrar, The College of Petroleum Studies, Administrative Offices, Sun Alliance House, New Inn Hall Street, Oxford OX1 2QD. Tel: (0865) 205521. Fax: (0865) 791474.

20th

London: Conference on 'Oil Price Information'. Details: Mrs Jean Etherton, Institute of Petroleum.

21st

London: Institute of Petroleum Annual Dinner. Details: Caroline Little, Institute of Petroleum.

FORTHCOMING EVENTS

26th-2nd March
Lausanne: 7th Advanced International Petroleum Economics Seminar (AIPES '90). Details: Dr Bob Gale, Seminar Manager, Petroleum Economics Limited, 17-19 Barter Street, London WC1A 2AQ.

28th-1st March
London: Conference on 'Flow Measurement of Commercially Important Fluids'. Details: Carol Gerrard, IBC Technical Services Ltd, Bath House (3rd Floor), 56 Holborn Viaduct, London EC1A 2EX. Tel: (01) 236 4080.

MARCH

6th-9th
Brighton: Conference and Exhibition on 'Defence Oceanology International'. Details: Judith Patten Public Relations, Rowe House, 55-59 Fife Road, Kingston upon Thames, Surrey KT1 1TA. Tel: (01) 547 1566. Fax: (01) 547 1143.

8th
London: Conference on 'Iraq in the 1990s'. Details: Royal Institute of International Affairs, 10 St James's Square, London SW1Y 4LE. Tel: (01) 930 2233.

12th–14th
Oxford: Course on 'Joint Interest Ventures for Oilfield Operations'. Details: The Registrar, The College of Petroleum Studies, Administrative Offices, Sun Alliance House, New Inn Hall Street, Oxford OX1 2QD. Tel: (0865) 205521. Fax: (0865) 791474.

12th–14th
Bahrain: 'The First Middle East International Quality Assurance Conference — The Quality Challenge'. Details: The Quality Challenge Conference Secretary, The Institute of Quality Assurance, 10 Grosvenor Gardens, London SW1W 0DQ. Tel: (01) 730 7154. Fax: (01) 824 8030.

CHANGE OF DATE

National Oil Corporation
(in collaboration with operating oil companies in Libya)

Technical Symposium on EOR in Libya:
Today's Perspectives, Tomorrow's Direction
Tripoli, Libya, May 1–2 1990

Details: Symposium Organising Committee, Attn. A Misellati/E Egbogh, National Oil Corporation, PO Box 2655, Tripoli, Libya. Tel: (318 21) 46181. Telex: 20270 LINAFT LY.

19th–23rd
Zurich: Course on 'Multiphase Flow and Heat Transfer: Bases and Applications in a) the nuclear power industry b) the process industries. Details: Prof. G Yadigaroglu, ETH-Zentrum, CH-8092 Zurich, Switzerland. Tel: (+41) 1 256 4615.

20th
London: Lecture on 'Drag Reducing Agents in Pipeline Systems' by S Ubels and M J Monahan, Conoco Ltd. Details: The Pipelines Industries Guild, 17 Grosvenor Crescent, London SW1X 7ES. Tel: (01) 235 7938.

20th
London: Conference on 'Energy Information for 1992'. Details: Caroline Little, The Institute of Petroleum.

22nd-23rd
Guildford: Conference on '25 Years of the North Sea'. Details: Mr David Hawdon, Surrey Economics Centre, University of Surrey, Guildford, Surrey GU2 5XH. Tel: (0483) 571281.

25th-31st
Dundee: Conference on 'International Aspects of Energy Law'. Details: Marjorie Meek, Assistant Director, Courses Department, The British Council, 65 Davies Street, London W1Y 2AA. Tel: (01) 930 8466. Fax: (01) 493 5035.

26th–30th
Leeds: Conference on 'Diesel Particulates'. Details: Mrs C. Shirley, Senior Administrative Assistant, Department of Continued Professional Education, The University of Leeds, Leeds LS2 9JT. Tel: (0532) 431751. Fax: (0532) 336017.

26th–30th
Oxford: Course on 'Crude Oil Supply, Transportation, Refining and Trading'. Details: The Registrar, The College of Petroleum Studies, Administrative Offices, Sun Alliance House, New Inn Hall Street, Oxford OX1 2QD. Tel: (0865) 205521. Fax: (0865) 791474.

27th-29th
Aberdeen: Conference on 'Offshore Abandonment and Removal 90'. Details: Offshore Conferences and Exhibitions Ltd, Rowe House, 55-59 Fife Road, Kingston upon Thames, Surrey KT1 1TA. Tel: (01) 549 5831. Fax: (01) 541 5657.

April

2nd–6th
Oxford: Course on 'Major Capital Projects in Oil and Gas: Managing Development and Implementation'. Details: The Registrar, The College of Petroleum Studies, Administrative Offices, Alliance House, New Inn Hall Street, Oxford OX1 2QD. Tel: (0865) 205521. Fax: (0865) 791474.

4th
London: Conference on 'The European Auto-Diesel Challenge'. Details: Caroline Little, The Institute of Petroleum.

4th–5th
London: Conference on 'Subsea Controls & Data Acquisition'. Details: Jean Pritchard, Conference Organiser, Society for Subsea Engineering, 76 Mark Lane, London EC3R 7JN. Tel: (01) 481 0750. Fax: (01) 481 4001.

24th
Birmingham: Course on 'Understanding Heat Treatment'. Details: Course Administrator, Wolfson Heat Treatment Centre, Aston University, Aston Triangle, Birmingham B4 7ET. Tel: (021) 359 3611. Fax: (021) 359 6470.

23rd–24th
London: Seminar on 'An Economic and Technical Review of Water Injection in the 1990s'. Details: Robin Evans, Serck Baker Limited, Riga House, 380 Bristol Road, Gloucester GL2 6XY.

25th
London: Conference on 'Microbiological Risk Assessments for COSHH'. Details: Caroline Little, The Institute of Petroleum.

Product Identification System for marketing operations and distribution

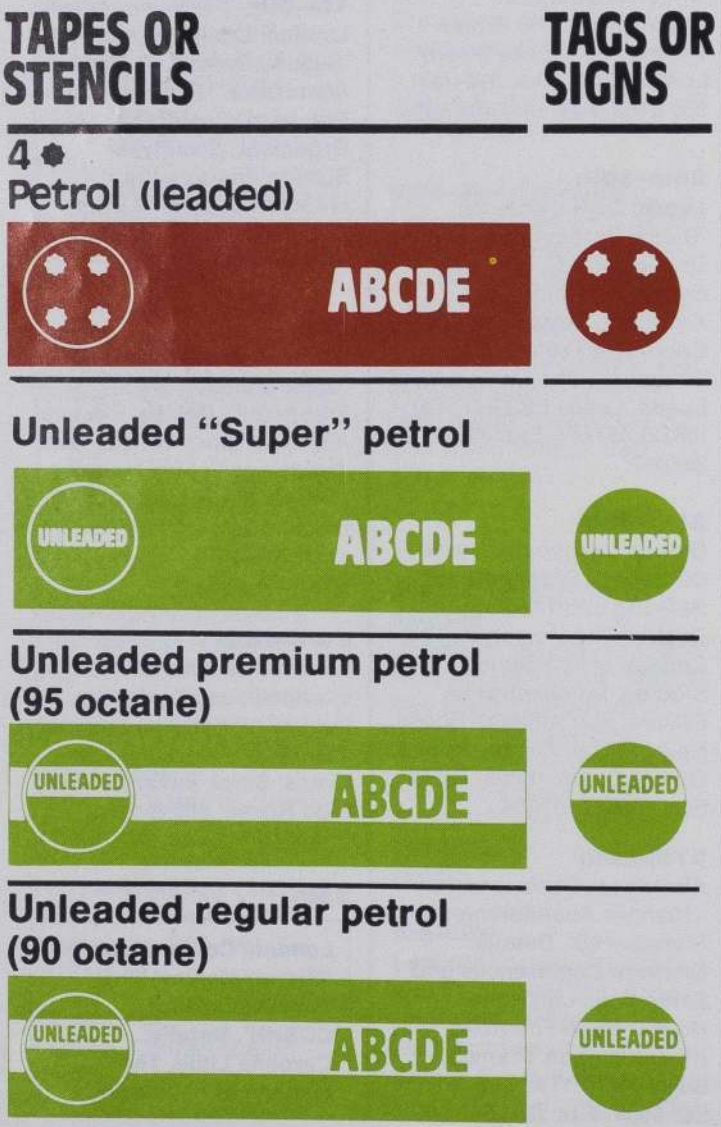
The introduction of a 'super' grade of unleaded petrol in the United Kingdom has necessitated some revision of the coloured card which accompanies the Institute's code of practice, in order to reflect accurately the principles expressed in the document, viz:—

1. 'Super' grade — solid green
2. Lower grades — white banded
3. All grades to contain the word unleaded

Whilst revising the illustrations shown on the card for unleaded petrol, the IP Working Group took the opportunity to remove those for the two and three star leaded grades as these grades are no longer available.

The coloured illustration shows an oversticker which is available for attaching to existing cards. As will be appreciated, the letters ABCDE in the illustrations indicate where a company's product brand name may be printed.

Copies of the code are available from the Institute, price £7 (overseas £10).



Oil Supply and Price Conference

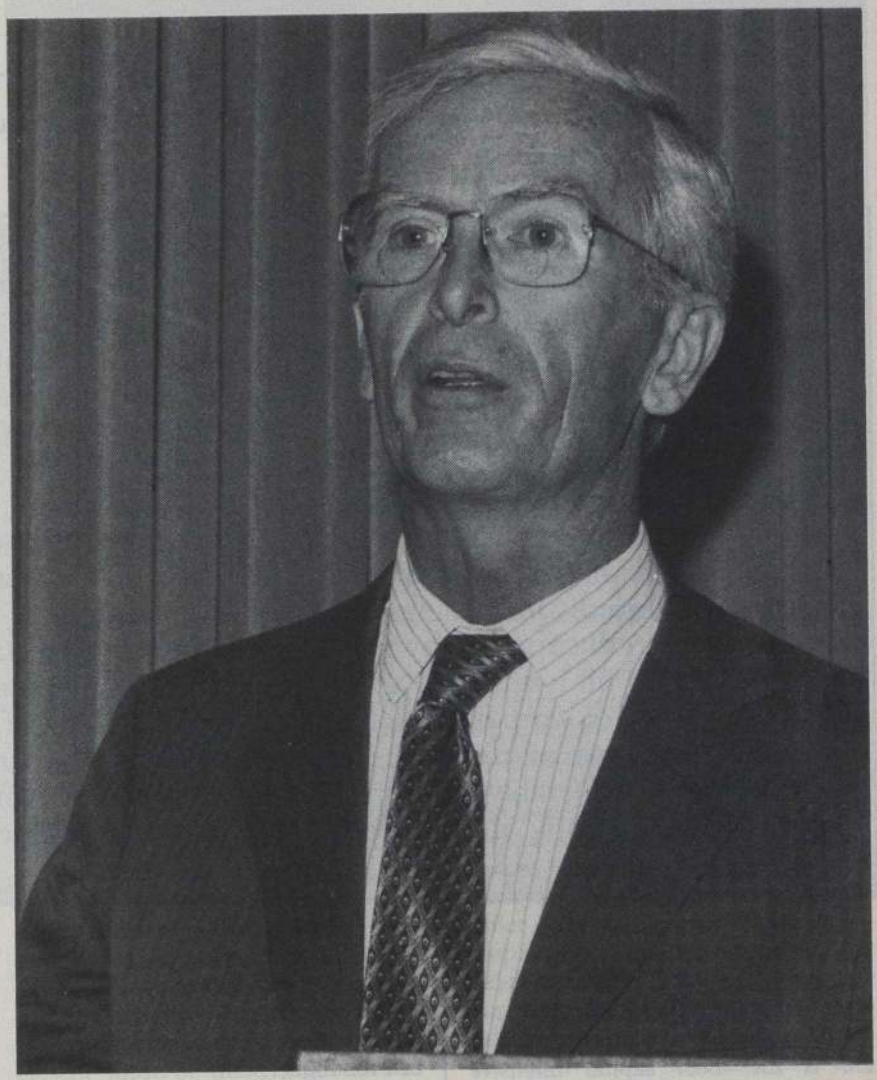
Sir Peter Holmes, Chairman of Shell Transport and Trading, delivered the keynote address to the Institute of Petroleum's conference on Oil Supply and Price. Sir Peter showed a number of slides to illustrate the point that in the past both the industry generally and Shell had often been wrong in forecasts both for demand and price. On the demand side, for example, Shell underestimated demand until 1973 and overestimated it after that. Price forecasts were also 'a sorry tale'. Under such circumstances, management's job had been to 'steer the company through uncertainty'.

Oil demand

In the last decade, oil demand in Europe has been relatively stable. In the Far East, demand has been growing recently by 7 to 8 percent per annum — 'that is significant'. In the future, as in the past, growth in oil demand will be strongest in the non-OECD countries, stressed Sir Peter.

Switching to the United States, Sir Peter pointed out that the domestic crude market there was exceptionally sensitive to price changes. With import volumes increasing, there is a need to promote efficiency of oil use, for which a tax on gasoline would be one option, and to encourage domestic crude production.

Shell estimates for the Eastern bloc see production falling but Sir Peter said that this is an area for which the outlook is particularly uncertain in the current atmosphere of *perestroika.*



Sir Peter Holmes.

Elsewhere outside OPEC, Sir Peter said that the most important factor during the last 12 months had been the level of unscheduled disruptions which had provided greater scope for OPEC production. Nevertheless, he called the success with which OPEC had managed to hold together, despite the different interests of its members, as 'quite astonishing'.

Growth of gas

Gas has been a growth industry and will impinge more and more on oil as the years go by, said Sir Peter. At the moment relatively small volumes of gas cross frontiers compared with oil but it is an energy source which is more widely spread throughout the world; and it is environmentally 'more friendly' than oil.

Notwithstanding the perils of forecasting, Sir Peter revealed that Shell's current estimate for the price of oil is a roller-coaster in the range of $10–20 a barrel for many years to come. Demand is expected to continue to increase, albeit more gradually than of late.

Meeting USSR oil requirements

By Professor AA Arbatov, Committee for Productive Forces and Natural Resources, USSR Academy of Sciences, Moscow

Since 1974 the USSR has been the world's leading oil producer. Oil plays a particularly important role in the country's economy. Apart from being a raw material in the power and petrochemical industries, it is the Soviet Union's main export item. For a number of years it accounted for more than half of foreign exchange earnings in convertible currency. For the past 15 years, oil export earnings have been used to purchase Western goods and equipment with the aim of alleviating food shortages, raising the technological standards of industry and improving the internal trade balance. The Soviet economy is therefore extremely sensitive to price changes on the world oil market.

At present the Soviet oil industry is faced with a number of serious problems. Its largest and most productive oil deposits are nearly exhausted. The water content of the extracted oil is high and is constantly increasing. The share of small and low-yielding deposits in the overall pattern of oil production is growing. There is an acute shortage of modern equipment and materials for the oil industry. Various infrastructural facilities for oil production are either poorly developed or worn out. And lastly, there are still many unsolved social and ecological problems in the main oil-producing regions. In the last 15 years, the average yield of oil wells has dropped considerably, as a result of the intensive working of the most productive deposits. The recently discovered oil deposits are inferior in terms of quantity and productivity.

Oil and investment

Oil is the most capital intensive product, not only of the Soviet energy sector, but of the whole economy. During the twelfth five-year plan period (1981–1985), total investments in industry increased less than 20 percent, while investments in fuel production grew by 53 percent to reach 80 billion roubles (in 1984 prices). Of this amount, 50 billion roubles were invested in the oil industry. This sum exceeds the overall increase in investment in oil production for the preceding 10 years. Approximately one out of every seven roubles invested in industry during 1981–85 went to the extraction of oil. Owing to a drop in oil output, investments in the oil industry rose sharply after 1985. The forecast is that in the 1990s, if oil output is to be maintained at a level of 620 million tons a year, it will account for 10 percent of total investments. According to some estimates, the figure may be even higher.

As the country has many other unresolved problems, it is not in a position to invest so much in the oil industry. It will have to lower the level of oil production to an economically acceptable level. How is that level to be defined? And how can it be achieved? The answers to these questions will affect not only the future of the oil industry but the future of the entire Soviet economy. Some of the problems involved here concern the energy sector alone but there are others whose solution will require major structural changes in the economy. The solution of some problems will take time, while others, such as the more economical use of oil, can be solved relatively quickly since mostly organisational measures are called for and no large outlays are necessary.

Industry efficiency

One set of measures comprises the following. There should be more extensive refining of oil in order to increase the yield of light fractions. Fuel oil should be replaced by gas and coal whenever possible. The efficiency of internal combustion engines should be raised so that they will consume less fuel; at present they are one and a half to two times less efficient than their foreign-made counterparts. Gas condensate should be used more extensively as fuel and energy carriers. Motor fuel should be upgraded by using various gas and liquid additives. Different energy sources (compressed and liquefied gas, methanol, electricity) should be used for operating motors. And light hydrocarbon fractions (ethane, propane and butane) should be produced on a larger scale and used more widely than at present.

Measures to process oil more extensively would necessitate the reconstruction of the entire oil refining industry. According to experts' estimates, after a complete overhaul, annual investments in oil production could be reduced by about 2.3 billion roubles, as compared with the average annual level of investment at present. And this figure would be one and a half to two times higher if the estimates were to be based on the performance of the least efficient oil refining facilities. As for the amount of expenditure that can be saved each year by carrying out the other measures mentioned above, they vary from 0.5–0.7 to two billion roubles.

A second set of mostly organisational measures which could yield quick returns, include raising the efficiency of the management of oil-refining plants; better regulation of economic relations between factories and plants; perfecting the mechanism of price formation; and working out a system of material incentives and fines aimed at encouraging fuel economies. In Hungary, for example, a big saving of motor gasoline was registered when gasoline coupons for government vehicles were abolished and drivers instead bought gasoline with ready cash.

Another way to save fuel is through better management of freight transport and the reduction of the number of empty truck journeys. The price level for motor fuel should be pitched so that it would encourage the use of alternative, less fuel-intensive motor transport. Credits and loans should be granted on preferential terms for the development of fuel-saving technologies. On the other hand, taxes on the use of obsolescent equipment and technologies requiring large quantities of petroleum products should be increased.

Professor Alexander A Arbatov

great shortages of many types of goods, large quantities of goods are being produced for which there is no demand or which are used for purposes other than those for which they are intended. Cautious estimates put the share of such goods in the total output of Soviet industries at 25 percent. Thus, in 1987 the cost of uninstalled equipment kept in warehouses and of idle equipment in capital construction, amounted to 13.9 billion roubles, of which over 25 percent is above the permitted quotas. What happens is that large quantities of the products of the machine building industry are used as spare parts. At present most of these products are

'At present the Soviet oil industry is faced with a number of serious problems'

Among the organisational measures aimed not only at saving oil and other natural resources, but also at restructuring the Soviet economy, is one of particular importance. It calls for the drawing up of a list of all the products for which there is no demand and the closing down of plants that make them.

Consumption priorities

A curious thing about the state of the Soviet economy is that while there are centrally distributed, and factories and plants have to accept what is alloted to them. Therefore, almost all the unused products are scattered among the consumers. This makes it difficult to pinpoint the major producers of such goods. But once the factories and plants become independent in decision-making, more and more of the goods for which there is no demand will remain in the hands of the producers.

The closing down, or reorganisation, of enterprises making unwanted goods should have an immediate beneficial effect on the state of the economy. It will mean decreasing the consumption of energy and materials, freeing production premises and thus reducing the need for the erection of new production facilities. The employees of such enterprises will receive compensation, which will not exceed their wages or salaries. Certain outlays will probably be necessary in order to create jobs for these employees. However, this should not be a large problem, since there are currently labour shortages and it is now possible for individuals to form cooperatives and conclude lease contracts.

Another, more considerable, measure to lower oil consumption would be a reduction of output in the armed forces and the defence industry. Scrapping the production of many types of defence goods would obviously lead to a lowering of fuel consumption. And not only would current fuel consumption levels be lowered, a decrease in the volume of the reproduction cycles which are connected with arms manufacture but which largely lie outside the defence industry would be the main energy-saving factor. Energy-intensive activities such as the extraction and enrichment of ores and the smelting and working of metal can be substantially cut back. A comprehensive analysis shows that the total amount of

energy that can be saved as a result of a reduction in defence industry output is comparable to what the most promising energy-saving programmes can achieve.

'Oil is a least preferred export item'

Oil exports and the rouble

One of the most important ways to lower the level of oil production is to reduce oil exports. Here both administrative and economic measures can be taken. One measure, currently under active consideration, provides for the farmers to be paid in convertible currency for quantities of grain produced above their compulsory deliveries to the state. The compulsory deliveries are paid for in roubles, according to the set procurement prices. For grain produced above the quotas, farmers would be paid in convertible currency, but at prices lower than the world prices. The farmers could use the convertible currency to purchase foreign-made goods which they need. It is hoped that such a measure will encourage the domestic farming sector, which is keen to acquire imported technologies and consumer goods, in order to be able to produce without large investments, a considerable part of the grain currently imported. This will also help lower the level of oil production.

Another measure calls for changing the exchange rate to the socialist countries. At the present rate of exchange these countries found it advantageous to purchase oil from the Soviet Union at average prices for the past five-year period, even when world oil prices were fairly low. Such a measure, together with the settling of accounts between socialist countries in convertible currency, could bring about a situation in which other socialist countries would turn to the world oil market and thus reduce their oil imports from the Soviet Union, such imports being provided for under long-term agreements.

Oil exports can also be reduced by appropriate economic measures. Here it is important to examine closely the aims for which oil, and, for that matter, other raw materials, are exported. These aims include the purchase from abroad of certain types of goods and services and the satisfaction of other requirements by means of convertible currency or on the basis of exchange of mutually agreed terms.

The significance of imported goods is determined by a number of considerations; how efficiently the imported goods are used; whether it is technically feasible and economically advantageous to produce such goods at home; the disadvantages of not having such goods; the way in which the imported goods will promote the competitiveness of goods manufactured domestically. To this end, three major categories of imported goods may be identified:

- goods which will bring more economic benefits to the country than the cost of producing oil for export, or goods which the country cannot itself produce in the foreseeable future;
- goods which the country can produce itself but whose production will require large investment;
- goods which are imported without sufficiently good reason.

At present oil is a least preferred export item. Therefore, the volume of oil exports is determined on the basis of the second category of imported goods. The import of goods of the first category is considered advantageous and absolutely necessary, while the third category will soon be stopped regardless of the export possibilities.

On the basis of these considerations, the volume of oil exports and their economic efficiency can be assessed by comparing the expenditure on the least productive oil deposits, with the amount of money the country would have to spend if it were to produce the goods it currently imports. In order to reduce oil exports, those oil deposits requiring the smallest amount of expenditure, which can be tapped within the shortest period of time, and which will also help maintain a balance between imports and exports are produced. By comparing expenditure on the production of oil to be exported and that involved in producing the goods currently being imported (or the losses for the country if such goods were not imported), one can identify several types of imports which together represent the total volume of expenditures on working those oil deposits whose continued exploitation would be desirable.

In the event of expenditure on the production of oil for export exceeding that for producing goods currently being imported (this is most likely at present), the amount of money earmarked for the extraction of oil for export is turned over to the production of goods of the second category mentioned above.

Demand at home

Estimates have been made of domestic oil requirements at various periods. Here it is assumed that oil requirements are determined by requirements in motor fuel for automobiles. The needs of all other major consumers of petroleum products are satisfied on the basis of calculated demands for gasoline and diesel fuel.

As the number of automobiles grows, so does the demand for motor fuel. According to estimates based on the relevant long-term plans, the number of motor vehicles will be 1.15–1.25 times greater in 1990, compared with the 1985 figure; 1.52–1.95 times greater in the year 2000: and 2.01–3.05 times greater in the year 2010. In other words, in order to meet future motor fuel needs, it would be necessary to refine annually 800–1,200 million tons of oil, in order to satisfy these levels of demand. However, the figures are clearly unrealistic both in terms of the expenditures involved and of resources.

Therefore, attention was turned to ways of reducing oil consumption. Of the many ways of achieving this, the most realistic ones, or those which have proved effective in the Soviet Union and in other countries, were chosen, as well as those which have been widely applied in industry. These include the use of alternative fuels and additives, designing fuel-economy transport and improving the efficiency of such transport. Quantitative estimates were made for all these methods of saving oil, with account taken of both Soviet economic and technological potentialities and the experience of other countries. The figures used for these estimates are not the most favourable but are, in the main the lowest ones.

On the basis of these estimates, calculations were made of the coefficient of the volume of automobile transport up to the year 2010, with that of 1985 taken as unity. In the year 2000, the maximum value of this coefficient will be 1.27, and the minimum −0.83; the corresponding figures for the year 2010 are 1.39 and 0.61. These figures show that it is possible to

increase the volume of transport 2.5 times without enlarging the fleet of transport vehicles.

As mentioned above, extensive processing of oil is one way of reducing the requirements for oil. If by the year 2010 the refinery throughput reaches 87 percent (the present US level), compared with 58 percent in 1985, and as a result 51 percent of gasoline and fuel oil are obtained, the average domestic requirements for oil in 2010 will be 420 million tons. There will be a surplus of 30 million tons of gasoline, which can be used by the petrochemical industry or exported, although it will then be necessary to substitute gas or coal for fuel oil. Thus, even with a decrease in oil exports by more than 50 percent, the Soviet Union will be able to meet its oil requirements of around 500 million tons in 2010.

Policy choices

Another factor that should be taken into account here are government plans to make the rouble convertible within six to eight years. When this takes place oil output will be determined by the cost of oil production plus the rate of profit which must not exceed world oil prices. But this does not mean that such a volume of oil production will always be maintained. Very likely a different situation will emerge. As more and more money is invested in the production of goods with a high degree of processing, such goods will quickly become competitive on the world market. In these circumstances it will be profitable for the Soviet Union to import oil. Thus, it is not impossible that the Soviet Union will assume a quite different role in the world oil market, thereby altering the global pattern of oil production. Should such an event come to pass, the USSR will be in a position to resort to three means of satisfying its oil requirements: self-reliance, net import and net export. How it will use these three means will depend on world oil prices and on the economic situation inside the country. Such a scenario would be extremely favourable for the Soviet Union since any of the variants would bring advantages, or at least minimise losses.

If the Soviet Union assumes such a position, it would not infringe on the interests of any other country. In fact, it would be a stabilising factor and help to keep the world system of oil supplies in a state of dynamic balance. The role of the Soviet Union here would be similar to that of the oil transnationals. Several oil exporting countries have already embarked upon such a road and are carrying out a reorganisation of their oil industry. These trends will promote a more stable situation in the world oil market, which will benefit both producers and consumers.

For this scenario to become a reality in the Soviet Union, a number of problems need to be solved. The two most important are as follows. The first is economic in character, and comprises the need for an overall improvement of the Soviet economy and the convertibility of the rouble. The second problem is of an organisational and legal character. It consists of the decentralisation of the oil industry and the diversification of activity in newly-created competing sectors, ranging from geological survey to the sale of petroleum products and other highly processed goods. How adequately the Soviet Union will meet its oil requirements in future, will depend on how successfully it solves these two problems. ■

European refining: further modernisation needed

By Trevor Morgan, Consultant, Coopers & Lybrand

This article, written specially for *Petroleum Review*, is based on a report which originally appeared in the DRI European Oil Monitor when the author was affiliated with DRI International Energy Services. It surveys the current state of the refining industry in Europe and its prospects into the early 1990s. A tightening of available refinery upgrading capacity and a dearth of new investments will limit European refiners' ability to meet rising demand for light products and is likely to result in a widening of prices between light and heavy products on spot markets over the next couple of years.

The oil price shocks of the early and late 1970s led to a downturn in oil demand by the early 1980s throughout most parts of the world. Together with the time lags in construction of new refineries started in the mid-1970s which caused distillation capacity to peak in 1980 worldwide, this slump in demand led rapidly to a situation of chronic surplus refining capacity throughout the developed world. Surplus capacity was particularly acute in Europe. From a utilization rate of 88 percent in 1970, European refineries were running at only 61 percent of distillation capacity by 1980. Oil companies reacted to this huge overcapacity by shutting down large numbers of inefficient refineries and cutting back distillation capacity sharply. In total, distillation capacity was reduced by over 6.2 million b/d to 13.8 million b/d in Western Europe from 1980 to 1988. This rationalization was most severe in Germany, which lost 17 of its 32 refineries and 1.7 million b/d of distillation capacity to only 1.5 million b/d over the period 1978 to 1988.

Since the early 1980s, the combined effects of refinery closures and a recovery in oil demand have led to a steady rise in utilization rates in Europe. Although most countries' refinery industries are now running at reasonably high rates of utilization, there nevertheless still exists sizable surplus distillation capacity in some countries. By contrast, reformers and upgrading units — crackers, visbreakers and cokers — are now running at virtually full throttle (when not down for maintenance) to meet the rising demand for light products. **Table 1** shows recent trends in distillation and upgrading capacity.

The pattern of refinery restructuring and investment in new units has not been uniform across Europe. **Table 2** summaries the competitive positioning of the refining industries in the key European countries at present, in terms of the utilization of distillation capacity and the amount of upgrading capacity. West Germany and the United Kingdom stand out as the most advanced in terms of upgrading to distillation capacities, while Italian refining remains relatively unsophisticated.

Upgrading capacity

Upgrading capacity in Europe is already being almost fully utilized. Four factors will contribute to the need for more upgrading capacity in Europe in the coming years: first, rising demand for light products — particularly gasoline, naphtha and jet kerosene; second, an expected decline in the gravity of imported crude. Demand for gasoline in 1989 is expected to show a gain of over 2 percent in Western Europe compared to the previous year. The phase-out of leaded gasoline in Europe will also have the effect of reducing gasoline yields as refiners reform more severely to boost octane, thus exacerbating the need for more reforming and cracking capacity.

Third, stagnant demand for heavy fuel oil. Demand for fuel oil in Europe has been in decline over the last few years, particularly in the industrial sector where natural gas use has grown. Tighter environmental regulations and increasing competition from natural gas in the power generation and industrial sectors are expected to depress fuel oil prices — particularly those of high sulphur fuel — relative to the rest of the barrel (and possibly

Table 1: Distillation and Upgrading Capacities in Western Europe
(million barrels/day)

	1970	1980	1985	1986	1987	1988
Distillation	14.43	20.06	14.66	14.36	14.04	13.84
Upgrading Capacity	1.33	1.91	3.35	3.36	3.63	3.80
Dist Utilization Rate %	88.2	61.5	64.7	70.3	69.9	71.0*
% Upgrading to Dist	10.8	10.5	22.9	23.4	25.9	27.4

*Estimate

Notes: Upgrading is defined as catalytic and hydro-cracking, visbreaking and coking; Western Europe is defined as EEC plus Austria, Finland, Norway, Sweden, Switzerland, Turkey; capacities are year-end.

demand) and thus the economics of simple refining over the next few years.

Fourth, long-term declines in North Sea crude production and a growing reliance on Middle East crude imports, will almost certainly lead to a gradual fall in the average gravity of crude inputs in European refineries over the next few years. This will naturally lead to a decline in yields of light products and an increase in heavy fuel oil yields, unless there is a corresponding increase in upgrading.

Investment shortfall

The growing demand for light products and imminent decline in crude quality is not being matched as yet by investments in upgrading units in Europe. **Table 1** shows that most of the increase in upgrading capacity in Europe over the last decade took place before 1985; the amount of upgrading capacity has risen by only 450,000 b/d (13 percent) from 1985 to the end of 1988, compared with a jump of 1.44 million b/d (75 percent) over the period 1980–1985.

Almost all upgrading units now under construction will be brought on-stream this year, which will add 200,000 b/d or 5 percent to last year's total conversion capacity of 3.8 million b/d. Investment in upgrading is expected to pick up in the early 1990s as the economics of conversion improve, which should lead to a more rapid increase in available upgrading capacity in the mid-1990s. Total upgrading capacity is projected to rise from 3.8 million b/d in 1989 to 4.4 million b/d by 1995 — mostly accounted for by catalytic and hydro-cracking. **Table 3** summarizes actual and projected upgrading capacities in Europe through to the year 1995.

The need for more upgrading capacity can be seen clearly in the recent widening in spot prices between gasoline and the heavier products, which has significantly improved the profitability of reforming and cracking. Why have oil companies been so slow to respond to the need to invest in more upgrading? Several factors may explain this phenomenon: paltry refinery margins over recent years have led to a general reluctance to invest in refining; oil companies have clearly not been convinced of the durability in the longer-term of a wide price spread between gasoline and residual fuel which would make investments in crackers economic; a shift in oil company policy in the wake of heavy refining losses in the early 1980s, towards short-term profitability and refining flexibility at the expense of long-term strategic planning; and, more recently, a pre-occupation with meeting octane levels while reducing lead additives in gasoline through investments in alkylation and isomerization plants.

Table 2: Refining Capacities in Western Europe
(million barrels/day)

	Dist Capacity (end 1988)	% Dist Utilization	% Upgrading to Dist (end 1988)
W. Germany	1.52	90	37
France	1.86	80	26
UK	1.80	90	34
Italy	2.45	65	22
Netherlands	1.38	85	25
Total W. Europe	13.84	71*	27

*Estimate

A continued widening of the price spread between light and heavy products will greatly boost the economic viability of constructing new crackers and should lead to more investment in upgrading over the next few years. However, given that it takes three to four years to plan and two to three years to build a cracker, it will not be until the early to mid-1990s that upgrading capacity in operation is significantly increased. Recent developments and the outlook for the early 1990s for the refining industry, in each of the major Western European countries will now be summarized.

European outlook: West Germany

The drastic cutback in German distillation capacity since the late 1970s has brought a turnaround in the financial fortunes of German refiners. 1988 saw two more refineries shut down (Wintershall's Mannheim refinery and Deutsche Fina's ERD refinery in Duisburg), but the old Esso refinery in Hamburg (renamed Holborn Europa) was brought back into production. The net loss in distillation capacity was 200,000 b/d or 1 million tonnes/year by the end of 1988. Cuts in distillation capacity over recent years have rendered West Germany a net importer of products; product imports totalled roughly 900,000 b/d (40 million tonnes) in 1988 mainly from the Netherlands and Belgium.

As a result of these moves, West Germany now has one of the highest ratios of upgrading to distillation capacity in Europe — 37 percent compared with an average for Europe of 27 percent. Despite the current profitability of cracking operations, West German refiners are nonetheless having to cope with higher costs of production than in other European countries because of tighter environmental controls (estimated at just over $3/tonne at present, rising probably to over $10/tonne by 1993 as a result of new regulations). There are no major plans to build any new crackers or reformers in West Germany in the near future, although Deutsche Shell/Wintershall is planning a revamp and 5,000 b/d expansion of its 15,000 b/d reformer at its Lingen refinery for this year.

France and the UK

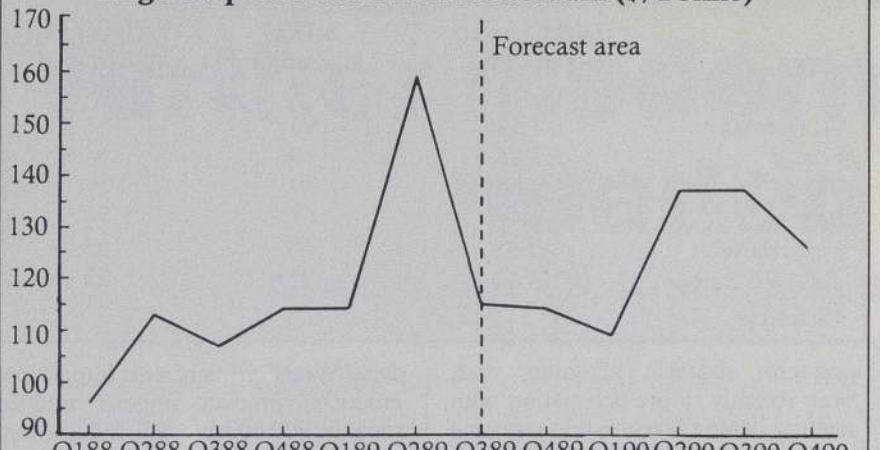
French refiners, in line with most other European refiners, have cut distillation capacity substantially since the early 1980s from 2.5 million b/d in 1983, to less than 1.9 million b/d at present. The increase in upgrading capacity to around 26 percent of distillation capacity has been insufficient to meet growing demand for gasoline and light distillates, which has resulted in higher imports. There remains some scope for installation of more upgrading units in

Table 3: Projected Upgrading Capacities in W. European Refineries
(million barrels/day, year-end)

	1988	1989	1990	1995
Cracking	2.45	2.46	2.53	2.77
Visbreaking	1.16	1.22	1.22	1.30
Coking	0.19	0.23	0.26	0.33
Total Upgrading	3.80	3.91	4.01	4.40

Source: DRI

Spot Price Differential between Premium Gasoline and High Sulphur Fuel Oil in Rotterdam ($/Tonne)



Source: Platt's (price data up to 3rd quarter 1989) DRI (forecast)

France, but only two projects are actually underway. Esso is due to open a 4,000 b/d FCC (fluid catalytic cracker) unit at its Port Jerome refinery early this year, having recently completed a 1,500 b/d FCC at its Fos-sur-Mer refinery; Elf is also building a FCC unit at its Mormant refinery, which is expected to come on stream at the end of the year (the capacity is unknown).

The United Kingdom refining industry is one of the most technically advanced in Europe with an upgrading to distillation capacity ratio of 34 percent, having trimmed distillation capacity by 165,000 b/d since 1983. The United Kingdom is already an important exporter of light products, mainly to the United States. There are no projects currently underway to increase further upgrading capacity at UK refineries, other than BP's 20,000 b/d expansion of its Grangemouth refinery in Scotland and a revamp of Texaco's 90,000 b/d catalytic cracker at its Pembroke refinery, which should be completed late this year. Elsewhere, some refinery de-bottlenecking may allow limited scope for increased gasoline output over the next year or two.

Italy and Holland

Cuts in distillation capacity have arrived late in Italy, which has meant that distillation utilization rates remain among the lowest in Europe at only 65 percent in 1988. Upgrading capacity is also limited, partly because tight government controls on domestic prices have depressed profitability and discouraged refiners from investing in new units.

Several projects to boost upgrading capacity in Italy are either underway or are planned. 85,000 b/d of extra visbreaking, thermal cracking and coking capacity will have come on stream by the end of last year, boosting total upgrading capacity to 625,000 b/d. A further 11,000 b/d of hydrocracking capacity, 38,000 b/d of FCC capacity and 19,000 b/d of coking capacity is planned for 1990 in addition to an 11,000 b/d reformer. The ratio of upgrading to distillation should thus rise to over 28 percent by the end of next year.

Dutch upgrading capacity at 25 percent of distillation is close to the European average. The export refineries in Rotterdam and Amsterdam tend to act as swing suppliers to the big German and US markets. No new upgrading units are planned at present, although Esso should complete de-bottlenecking of its flexicoker at its Rotterdam refinery by next spring, while KPC is due to complete a new 19,000 b/d catalytic reformer at its Europoort refinery.

Elsewhere in Europe, Spain is set to add to its upgrading capacity by mid-1990 with the completion of a 10,000 b/d catalytic cracker at Petromed's Castellon refinery and a 7,000 b/d coker at Repsol's Puertollano refinery. Outside the EEC, Turkey is planning 30,000 b/d of new cracking capacity and a 20,000 b/d visbreaker for 1992–1993, while a new FCC is planned for 1991 at the Scanraff refinery in Sweden.

The environment

Growing concern with environmental pollution is likely to impede refiners' ability to meet growing demand for light products. The current phase-out of leaded gasoline in Europe is perhaps the biggest challenge now facing the refining industry. European refiners, in the main, are opting to construct additional isomerization and alkylation plants to produce blending components capable of boosting octane in gasoline without lead additives. Nevertheless, more intensive reforming of reformate to produce high-octane unleaded gasoline will reduce gasoline yields and increase the need for more crackers. Moreover, if Europe goes the way of the United States in tightening vapour pressure regulations, further pressure would be added to construct more upgrading capacity. Pressure in Europe to reduce sulphur emissions, particularly in the power generation sector, is also prompting some countries to reduce the consumption of high sulphur fuel oil. This further increases the need for refiners to install more conversion capacity.

Product price spreads

In the meantime, it seems likely that crackers and reformers in Europe will remain stretched to capacity and that price spreads between gasoline and heavier products will tend to widen through to the early 1990s (see **graph**). The price of octane boosting additives, such as MTBE, are also likely to remain high over the next few years: the ratio of spot MTBE to premium gasoline prices has averaged about 1.6 since the start of this year, compared to historical levels of nearer 1.3.

It is inevitable that in the absence of sufficient upgrading capacity, refiners will have to boost crude runs to meet gasoline demand. This will lead to surplus output of heavy fuel oil and possibly distillate, although reduced Soviet exports to Western Europe is likely to offset increases in distillate output over the next year or so. This is likely to be exacerbated by the start up of Saudi Arabia's new export refinery at Rabigh later this year, which is expected to produce substantial volumes of gasoline and straight-run fuel oil for export to Europe. The only way refiners will be able to market surplus fuel oil to utilities and industrial end-users will be by cutting prices relative to the rest of the barrel. A widening of the gasoline/fuel oil price spread will encourage new upgrading projects to be launched in the early 1990s, which should eventually lead to reduced heavy fuel oil output and a narrowing of price spreads from the mid-1990s.

Over the next few years, refinery margins are expected to show a significant improvement for those refiners who already possess substantial upgrading capacity. Simple hydroskimming refineries, however, are set to become even more unprofitable as heavy fuel oil prices stagnate. Further closures of a few uneconomic refineries look inevitable over the next few years unless substantial finance can be found for modernization. ■

IFEG INFORMATION FOR ENERGY GROUP

OIL PRICE INFORMATION

20 February 1990

The Oil Price Information seminar has become a popular and regular feature during IP Week.

The programme of three papers on aspects of price information combined with an exhibition by suppliers of such information has proved to be a successful formula.

This year the seminar will present papers on electronic sourcing and analysis of oil price; the use of historical price data in future trading decisions; and the influence of OPEC on oil prices. The meeting will be of interest to traders, marketers, analysts, information providers and forecasters.

PROGRAMME

Chairman's Opening Remarks
Mr Silvan Robinson, CBE, Chairman, Energy and Environmental Programme, Royal Institute of International Affairs

Oil Price Information and Analysis — An Integrated Approach
Martin J Yates, Managing Director, Saladin Computer Systems Ltd.

Can Past Prices Predict Future Trends?
Meg Annesley, Oil Consultant

Sentiment as a Market Factor — Does OPEC Really Figure?
Peter Bild, European Representative, Oil Daily

Exhibits and Displays by Suppliers of Oil Price Information

Wine Reception

Exhibits will be provided by:
ICIS-LOR,
Saladin Computer Systems,
Telerate,
Petroleum Argus,
Reuters.

For a copy of the registration form, please contact **Mrs J Etherton**, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Telephone: **01–636 1004**. Telex: **264380**. Fax: **01–255 1472**.

NEW OPPORTUNITIES FOR FUEL OIL IN POWER GENERATION

Monday 19 February 1990

An Afternoon Conference
to be held at
The Institute of Petroleum

Registration and buffet lunch

Chairman: Mr A E H Williams, Director General, The Institute of Petroleum

Fuel Oil — a Return to the Power Generation Market? Mr Graham A Weale — Manager, WEFA ENERGY
Review of the current and forecast relationship between fuel oil and coal prices.

The Future Supply of Fuel Oil from the OPEC Exporting Refineries
Speaker from the Organisation for Arab Petroleum Exporting Countries
Fuel oil from OPEC refineries makes an important contribution in supplying the European market. How might the availability develop both by quantity and quality?

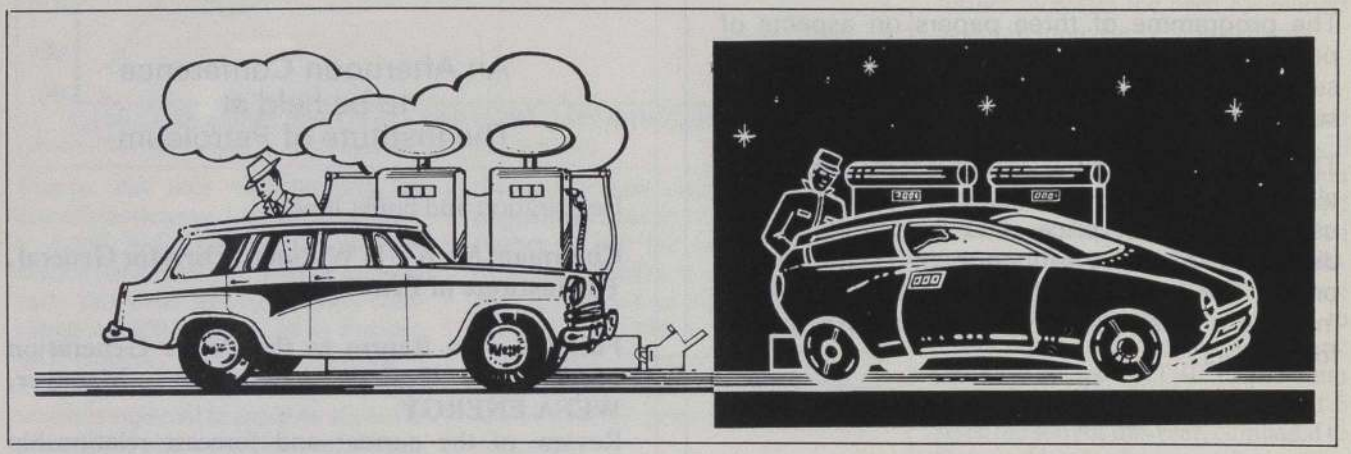
Power Generation Options in an Oil Refinery
Speaker from Conoco Refinery
For many years oil refineries have generated modest quantities of power. The opportunity to burn different streams according to their current availability and market value can impart an important element of flexibility to refinery operations. Alternative options open to refiners, including combined heat and power, will be reviewed.

Heavy Residue Gasification Schemes
Mr K M Brady, Licensing Manager, Texaco Development Corporation and Mr Lars Nelson, Managing Director, Skanraff Refinery
The residue gasification for power generation offers an interesting disposal route for heavy residues from a wide range of crude oils. Both the technology and the strategy behind the Skanraff refinery project will be discussed.

For a copy of the registration form, please contact **Susan Ashton**, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Telephone: **01–636 1004**. Telex: **264380**. Fax: **01–255 1472**.

New forecourt show comes to London

By Peter Noble



After getting by for years without its own dedicated exhibition, the forecourt sector will have two this year — the first in February in London and the second just four months later in Birmingham.

Both will be three-day events and will display the same range of products directed at the same audience. To increase the confusion, they have very similar titles. The Forecourt Retailing and Equipment Exhibition makes its debut at the Wembley Exhibition Hall from February 6 to 8, while the Forecourt Marketing and Equipment Exhibition opens its doors at the National Exhibition Centre on June 5.

The NEC event is already well established, with the 1990 show being the fourth in a line that stretches back to May 1987. Organised by Blenheim Exhibitions, it has demonstrated impressive growth in its brief life, attracting 130 exhibitors in its first year and progressively building up to last year's total of 230.

Such success does not go unnoticed in the highly competitive exhibitions world, and few were surprised when last July MGB Exhibitions of Sidcup, part of the giant Morgan Grampian publishing empire, threw its hat into the ring.

Although the newcomer is targeted at the same market, it claims to offer exhibitors and visitors two unique benefits — a London location and a timing tailored to coincide with what the organisers say is a key month for sourcing product for the peak summer months.

There is some scepticism in the industry about the validity of the latter point but there is wide acknowledgement that London could be the principal ingredient in the show's recipe for success.

FREE organiser, Peter Jakeman, emphasises that the Wembley event was launched in response to trade demand. 'We had people coming to us saying they wanted a London show. We spoke to a major oil company and a trade magazine and they confirmed the view that a lot of independent retailers in London and the south were not visiting the NEC show. Coincidentally, as exhibition organisers, our own view is that London is always a better venue for a retail show than Birmingham.'

MGB also believes that London is the natural and most popular location for a forecourt show because 50 percent of car registrations are in the southeast and because most of the policy-making and purchasing centres of the industry are based in the capital.

For confirmation MGB commissioned the independent market research agency, Mass-Observation, to carry out a nationwide telephone survey of 200 forecourt operators. That was completed in August and the results duly delivered the expected confirmation that London was the 'right' venue. Over 70 percent stated that they intended to visit the Wembley event in February (more than twice the number who said they had visited a major forecourt event within the past 12 months) and 26 percent said they used exhibitions as sources of information on forecourt products.

Armed with such ammunition and a £100,000 promotional budget, MGB set about filling the vast

open spaces it had reserved at the Wembley Exhibition Hall. By early October, it had sold around two-thirds of that space to 75 or so exhibitors.

Mr Jakeman feels that is a creditable performance for a new event. 'Our initial target was to sell 2,000 metres of display space, and that is what we have achieved so far. That is good going for a new show; some events in their second year do not reach that level.'

MGB clearly hopes and expects that FREE will copy the Blenheim-organised event and progressively grow over the next few years.

Despite MGB's research findings and its obvious enthusiasm, many companies are questioning whether the petrol retailing sector is large enough to support two almost identical exhibitions staged a few months apart from each other. The cost of exhibiting, they stress, is very high, with the staffing of the stand being probably the most expensive item. For that reason, many believe that eventually they will be faced with choosing between the two events or alternating their support.

The new show is a predictable mixture of forecourt equipment and shop products. A quick glance down the list of exhibitors reveals a number of forecourt equipment company names, but they serve to emphasise, rather than detract from, the dominance of shop product suppliers. It is a bias that may have something to do with MGB's involvement with the successful Neighbourhood Retailing Exhibition.

Conoco is the only oil group present, not wanting to miss any opportunity to promote its dealer package and boost network recruitment.

None of Britain's pump makers is present but there is a healthy contingent from the car wash industry, with the likes of Wilcomatic, Technorizon, Wesumat and Karcher, together with a sprinkling of pay-air machines (AirServ, Carebridge), trading stamps promoters (Blue Chip, Money Save) and others, such as Condor and Elaflex, which have a forecourt involvement.

The remainder of the stands offer visitors a cornucopia of shop products. Several mega-brands are present — Beecham Bovril, Coca-Cola Schweppes, Gallagher Tobacco, H.P. Bulmer and Walker Crisps — but it is an army of smaller suppliers that is the backbone of the show, displaying a wide and diverse range of goods, from toys and novelties through to videos. In particular, there are several companies who are anticipating a cold snap and are exhibiting pre-packaged fuels (Coal Products, British Fuels, Cornwall Coal Supplies). The automotive side is represented by Comma, with its well-known range of lubricants and cleaning chemicals.

Like its elder brother, the Forecourt Retailing and Equipment Exhibition is expected to reflect the market it serves by being lively and colourful. Whether it emulates the success of its elder brother remains to be seen. ■

OPEC

OPEC at the Crossroads, **Fadhil J Al-Chalabi (Pergamon Press, 1989), ISBN 0-08-037526-X, £30, 248pp.**

The book, a selection of speeches and articles by the author over the period 1981–88, places a contemporary spotlight on the main issues concerning OPEC over the last decade. Dr Al-Chalabi's direct involvement with OPEC began in 1968 when he started attending the organisation's meetings as a representative for Iraq and ended when he retired in 1988 after five years as Acting OPEC Secretary General.

Law

Joint Operating Agreements, **Michael PG Taylor and Thomas P Winsor (Longman Specials, 1989), ISBN 0-85121-239-5, 143pp.**

The Joint Operating Agreement is fundamental to every party involved in the exploration, development and production in oil and gas fields. It is the 'constitution' by which the joint venture is governed and under which operations are carried out. This specially commissioned report examines the Joint Operating Agreement as the contractual source of each party's rights and liabilities.

Futures

An Introduction to Commodity Futures and Options, **Nick Battley (McGraw-Hill Book Company, 1989), ISBN 0-07-707306-1, £15, 146pp.**

This book provides an introduction to commodity futures and options and assumes no prior knowledge of the subject. The book focuses on gas oil which as a futures contract demonstrates all the features common to the other commodities.

Offshore

The Offshore Health Handbook, **Professor J Nelson Norman and John Brebner (Best Publishing Company, Book number D258).**

A comprehensive manual for oil and gas rig personnel on coping with injury and illness.

Abandonment of United Kingdom Offshore Oil and Gas Installations — Fiscal, Security and Accounting Issues **(Ernst & Whinney, 1989), 66pp.**

The booklet is concerned with the financial implications of abandonment of offshore oil and gas installations, particularly in light of the 1987 Petroleum Act.

Fuel

Gasoline and Diesel Fuel Additives, **editor K Owen (John Wiley & Sons for the Society of Chemical Industry, 1989), ISBN 0-471-92216-1, £42.50, 173pp.**

Additives are more important now than they have ever been due to the phasing out of lead from gasoline, pressures to improve exhaust emissions and fuel economy and the economic need to minimise production costs and make the products more attractive to customers. The book covers the different additives used in gasoline and diesel fuel, the chemical nature of the additives themselves, how they function, the treatment rates used, methods of testing, the types of benefits achieved, difficulties that can be experienced and methods of handling.

Orimulsion — The revolutionary new fuel for power and industry, **Miri Zlatnar (Financial Times Business Information, 1989), £185, 97pp.**

Orimulsion, a bitumen-in-water emulsion, is being produced in Venezuela from the country's vast bitumen reserves. It is forecast to claim around 10 percent of the incremental demand for steam coal in the international market. The report defines exactly what Orimulsion is, how it is produced, transported and handled. The fuel's combustion performance in electricity and industrial boilers and its market potential worldwide is assessed.

Gas

Profit from Waste Utilising the Gas Turbine, **David V Laws (Transactions of The Institution of Diesel and Gas Turbine Engineers, August 1989), 8pp.**

This paper introduces the possibilities for utilising 'waste' gases as turbine fuel, highlighting the modifications necessary to the Ruston TB5000 gas turbine in particular to enable it to handle the various gas compositions.

Exploration

Energy Exploration and Exploitation, Volume 7 — Energy in Kenya, **editors D Abbot, G Jenkins (Multi-Science Publishing Co, 1989), £37.50, 156pp.**

A special issue of the Energy Exploration and Exploitation series which includes papers giving detailed energy balances for Kenya, comprehensive energy statistics, a bibliography of unsuccessful oil and gas exploration activities, the development of renewable resources and other energy related topics.

Petroleum Reserves

Proved Petroleum Reserves of 30 Large Energy Companies, 1981–88, **Bernard J Picchi and Ann Kohler (Salomon Brothers, 1989), 74pp.**

This report collects and organises public information about the petroleum reserves of 30 large US energy companies.

Prices

Oil Prices in the 1990s, **editor David Hawdon (Macmillan Press, 1989), ISBN 0-333-5109-5, £35, 127pp.**

The book examines the factors likely to affect oil prices in the longer run, including developments in world oil demand, the impact of energy conservation, investment in oil supplies, the market behaviour of Middle Eastern producers and a discussion of oil transport costs.

INFORMATION FOR ENERGY GROUP

ENERGY INFORMATION FOR 1992

20 March 1990

The single market offers new prospects and opportunities as well as potential difficulties. Careful planning and preparation will therefore be required.

This conference will be of particular interest to information specialists, needing to advise their organisations on rules and regulations and market conditions; to marketing managers and planners who may already be involved in or expanding into Europe.

The programme will include:

Keynote Speaker Mr Iain Miller, Engineering Markets Division, Department of Trade and Industry

The European Commission as an Information Source
Carlo Pau, Deputy Head of Media and Information, Commission of the European Communities

Key Published Sources — A Guide for the Perplexed
Nigel Spencer, Information Officer, British Library Business Information Service

The Production of European Standards for the Upstream Oil and Gas Industries
Mike Morris, The Oil Industry, E & P Forum

Energy Prices and Taxes
Andrew Buckley, Managing Director, Energy Information Centre

For a copy of the registration form, which will be available shortly, please contact **Caroline Little**, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Telephone: **01–636 1004**. Telex: **264380**. Fax: **01–255 1472**.

The Institute of Petroleum

THE EUROPEAN AUTO DIESEL CHALLENGE

A One-Day Conference Organised by the Energy Economics Group

Wednesday 4 April 1990

to be held at
The Institute of Petroleum

How are European auto diesel specifications developed to cope with increasingly stringent environmental legislation?

What is the outlook for auto diesel demand, particularly in view of potential 1992 fiscal changes?

What about the impact of the whiter European barrel on supplies of auto diesel fuel to meet stricter quality specifications? Can we meet the demand ourselves or must we import from Russia?

How do the manufacturers of diesel engines for cars and heavy goods vehicles view the new requirements, and can they economically modify their engines to suit?

Where do additives fit into this picture?

These and other relevant questions will be addressed by experts in their respective fields, including major European diesel engine manufacturers, government department and major oil company representatives.

For further information and a copy of the registration form, which will be available shortly, please contact **Caroline Little**, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Telephone: **01-636 1004**. Telex: **264380**. Fax: **01-255 1472**.

The Storage Stability of Oil Spill Dispersants

The Institute of Petroleum's Dispersant Working Group has completed an investigation into eight 'well-known' commercial oil spill dispersants to see if they would deteriorate under certain conditions of storage. This Executive Summary provides a review of the technical report of the three-year investigation which was undertaken by Warren Spring Laboratory.

Oil spill dispersants are stored in many places over long periods of time, often for more than 10–15 years, before being required for use at short notice. Sometimes bulk stocks are held in ships' tanks and then expected to be of good quality after years of storage.

The use of oil spill dispersants is regulated in the United Kingdom by the Food and Environment Protection Act 1989 Part II, and paragraph 21 of the Deposits in the Sea (Exemptions) Order 1985. Dispersants are approved for use by the Ministry of Agriculture, Fisheries and Food (MAFF), with the performance requirements tests being conducted by Warren Spring Laboratory (WSL), to the appropriate protocol described in the specification LR 448, or, if tested prior to 1983, to the earlier LR 316 specification. Dispersants once licensed by MAFF (or now approved) can still be used even though more stringent requirements are now in force.

Most major users of dispersants will hold supplies from more than one manufacturer and sometimes more than one type of product, e.g. hydrocarbon solvent based (type 1), water dilutable (type 2), or concentrate (type 3) depending on the method of application which might be used. The practice has developed of regularly checking dispersant quality to ensure that stocks held remain usable. These quality checks have indicated that some products could deteriorate under certain conditions of storage.

The problem of dispersant storage was raised by the UK Offshore Operators Association in 1984–85 and discussed at meetings of the Dispersants Working Group of the Marine Environment Committee of the Institute of Petroleum (now the Marine & Freshwater Environment Committee).

The faults that became evident after prolonged storage were identified as:

(i) A loss of performance (efficiency).

(ii) Phase separation into two liquids, with the efficiency of one layer being low.

(iii) Phase separation with solids being precipitated.

and less commonly,

(iv) Increased viscosity, discoloration and presence of rust and corrosion.

Proposals were made by the Dispersants Working Group to conduct an investigation using mildly accelerated storage conditions in the presence of sea water and mild steel, in order to find out the extent of the problem. Warren Spring Laboratory was selected as the contractor because of its involvement with the dispersant testing procedures.

A proposal to examine eight different 'well-known' dispersants in a sequence of tests was agreed, using the increase in organic acidity, increase in peroxide number and loss in efficiency (as measured by the laboratory rotating flask test) as the main criteria for change. Separately, the corrosion of mild steel coupons was used to follow corrosivity, both in the presence and absence of added seawater. Ambient storage samples in three different types of container were also laid down with provision for the drums to have limited access to air.

The eight different dispersants were selected from the present total of some 40 products now approved as type 3 dispersants according to the LR 448 specification and were chosen to represent the type of product currently being purchased for aerial or undiluted shipborne application.

Findings

The results from the three months storage tests at both 30°C and then 50°C showed that the eight different dispersants were very stable, as almost no loss of efficiency was apparent. However, some changes had occurred, since with certain products the repeatability of the test had worsened. Usually the test shows good repeatability if a product is highly efficient or has almost no efficiency; the borderline area is when a product is about 50 percent efficient, or when it exhibits a pronounced tendency to herd the test oil. Thus, the changes observed from a product giving a group of results of small spread, in the high efficiency region (say 80–90 percent) to a poor repeatability around a mean of 60 percent indicates some chemical deterioration but the product is still considered acceptable for use.

Acidity results tended to rise, notably in the 50°C storage test, and colour usually darkened. The peroxide numbers varied, decreasing in some products and rising in others. Generally the changes in peroxide number bore no relation to other observations.

The most interesting and important observation was the consistency of the results of the corrosion on the mild steel coupons. Products where seawater was added all showed some corrosion but other products, known to contain water in their formulation, also exhibited corrosion. The corrosion observed tended to be more pronounced above the liquid level although, in the worst cases, the corrosion extended over the whole test coupon.

Four of the dispersants, selected according to the degree of corrosion to mild steel coupons (ranging from low to high) were subjected to the standard MAFF Toxicity Test. Two samples of each selected dispersant were tested, one was fresh dispersant and the other was the product with added seawater and aged for 13 weeks at 50°C. The results showed that there was no significant difference between the toxicity of the samples comprising each pair indicating no significant change in toxicity after the accelerated storage.

In view of the fact that some type 3 (concentrate) dispersants are still used as type 2 (water dilutable), the effect of diluting the products 1 + 9 with seawater was assessed on samples pre- and post-accelerated temperature storage tests. The ageing of the products at 50°C in contact with mild steel and seawater for 13 weeks had little effect on the miscibility with seawater or on the viscosity of the dilutions although the rates of separation of the dilutions were, in some cases, slightly faster after ageing.

Conclusions

The conclusions from the project were that the eight products tested were all suited for long-term storage in the manufacturers' containers. Small dif-

ferences were detected which could not be interpreted over the limited timescale used for the accelerated test cycle. The corrosion results were in some cases worse than would have been expected and suggest that some simple corrosion test could be considered for inclusion in the present performance specification. The long-term ambient tests will continue until 1992 and may lead to a better understanding of the short-term accelerated tests when an appropriate timescale is reached.

It is evident that the eight dispersants tested have undergone no significant change in their performance after accelerated storage for 13 weeks at 50°C in the presence of seawater and mild steel. Also the toxicological properties of four selected dispersants showed no changes under these conditions. However, since the specification for oil spill dispersants is based not primarily on chemical composition but on efficiency and toxicity, it is recommended that:

1 Dispersants should, wherever possible, be kept in the manufacturers' containers, and according to manufacturers' instructions.

2 As far as possible, bulk storage of dispersants in mild steel containers should be avoided.

3 In circumstances where bulk storage cannot be avoided, occasions arise when old stock is topped up with new material. When this occurs, users must ensure that:

a Dispersants of different type, eg solvent based (Type 1) and concentrates (Type 3) are *not* mixed;

b The residual product in the tank has maintained its efficiency; and

c The new material, (if a different brand of product) is compatible with the residual stock.

Acknowledgement to Warren Spring Laboratory, whose Report LR670 (OP) price £10 (including UK postage and packaging) is available from Publication Sales, Warren Spring Laboratory, Gunnels Wood Road, Stevenage, Herts SG1 2BX.

A NEW IP CODE OF PRACTICE

DEVELOPING AN EMERGENCY RESPONSE PLAN FOR SERIOUS INCIDENTS INVOLVING PETROLEUM PRODUCT ROAD TANKERS

Responsible business practice requires that companies conveying hazardous materials should develop programmes to respond effectively to road transport incidents involving hazardous materials. Such companies have legal and social responsibilities to react promptly and properly to emergencies in which they are involved.

When a road tanker carrying petroleum products is involved in a serious road incident, the company operating that vehicle has a legal responsibility under the Health and Safety at Work Act to protect its own employees and members of the general public and also in most instances, to report the incident to the Health & Safety Executive. The company also has a moral responsibility to provide assistance at the scene of the incident either through its own or contractor resources. The economic implications themselves would also render such assistance important.

In addition, because of ever-increasing demands for the many different products that industry develops and transports, the emergency services have difficulty maintaining the technical expertise to deal safely with all road transport incidents involving hazardous materials. In such circumstances, the emergency services can call upon the operator or other members of the industry for assistance.

Emergency response plans should be devised for such incidents. The ability to respond properly to such incidents should be the concern of those who own the vehicles or materials, have custody of them or have responsibility for them through contractual or other agreements.

The ever-present concern of the Health and Safety Executive, over the volume of hazardous materials being transported in Great Britain and the hazards that this can create, has led those persons in the petroleum industry who are responsible for the road transportation of petroleum products, to recognise the need for the industry to strengthen its emergency response capabilities.

The issue of emergency response is of principal concern to the Institute of Petroleum's Engineering Marketing Sub-Committee, Panel 'C' and the members of this Panel determined that industry action was appropriate in four areas:

1. To increase industry awareness of the need to improve its emergency response capability,
2. To develop broad guidelines for devising emergency response plans,
3. To encourage adoption of 'mutual aid' practices to facilitate prompt remedial action, and
4. To develop guidelines for personnel who have the responsibility for 'hands on' emergency response to a dangerous incident on the road.

A company's emergency procedures and arrangements should cover for this type of incident. The procedures should be clearly documented and all company personnel likely to be involved should be suitably trained in order to be familiar with them. The procedures should be reviewed periodically to ensure that they are up-to-date.

When the police arrive on the scene of a hazardous materials emergency, they will normally assume control to contain the incident and co-ordinate the role of the other services, and decisions will usually be made within the first 30 minutes that will set the stage for subsequent operations. Whether or not the concerned company will be able to participate in this decision-making process will, as a general rule, depend on whether it has an effective emergency response plan and if the emergency services can contact the company quickly enough.

As response operations progress, various personnel including contracted personnel may become involved

along with the original respondents. The extent of their involvement will be influenced by decisions made within the critical first half-hour and the apparent capability of the original responders. It is essential to consult with the emergency services and personnel from other appropriate government bodies during the development and implementation of an emergency response plan. These bodies need to be aware of the company's response plans so that all efforts to control an incident can be properly co-ordinated and confusion as to the 'chain of command' avoided.

The emergency services are not able to provide training for all their personnel on all the appropriate techniques for responding to a specific hazardous materials incident, e.g. product transfer. Industry can therefore, help fill this gap in knowledge by keeping the emergency services informed of industry's capabilities. Industry may also be able to supplement the training of local emergency services personnel. Any effort in this direction would enhance public safety.

This new Code of Practice provides an outline of minimum recommended guidelines for developing a response plan for such an emergency situation, where a road tanker has been involved in a serious incident, possibly overturning and causing spillage of product which may damage or otherwise affect a third party, property or the general environment, and for co-ordinating and co-operating with the emergency services. In developing such a plan the Code defines four main priorities:

- the safety of on-scene team members must not be compromised;
- the safety of others at or near the scene must be ensured;
- the public must be protected; and
- the environment must be protected.

The plan must not be limited simply to the immediate control of the incident but must concern itself with all the subsequent actions necessary to resolve satisfactorily all the resulting problems.

The need for training company personnel in proper techniques and safety procedures is highlighted with particular reference to the specialised training given by the Petroleum Training Federation now used as the basis for most 'in-house' training.

Recommended specialised emergency response equipment and clothing is listed ranging from that required by the first attendee to the more specialised equipment necessary to transfer product and contain oil spills.

Protection of the environment is an important aspect of any such emergency situations and the Code clearly indicates that any response plan would need to take this into account.

The need to learn the lessons of any incident, the use of a 'third party' response, legal considerations and working with the media are all touched upon in the code. Such guidelines would need to be added to or modified to reflect an individual company's legal considerations and the capabilities of its response team.

Finally, the appendices to this Code provide a suggested outline of an emergency response plan, procedures for transferring petrol and oil; the roles of the various emergency services and the vehicle recovery contractor.

. . . people

Mr John Flynn, above, has been appointed UK System Sales Manager by Du Pont Imaging Systems Department. In this newly created position, he reports direct to the Sales Manager of NDT systems in the UK, **Mr Trevor Loydall**.

JP Kenny has restructured its Aberdeen Branch office to full company status with the formation of JP Kenny Caledonia Limited. **Dr Phil Ravens** will head the new company as Operations Director with **Mr Phil Brown** as Engineering Manager. All JP Kenny North Sea based engineering companies in London, Aberdeen and Stavanger, will now be co-ordinated and controlled as European Operations, with **Mr Richard Boan** as Director.

Mr Peter Elwes, above, has been appointed Deputy Chairman and Chief Executive of Hardy Oil and Gas Plc, following its demerger from Trafalgar House in 1989.

Mr Brian Cannan, BSc AMIEE, has joined Printed Motors Limited as Sales Manager (Director Designate). He will be responsible for expanding the company's business for all motion control products.

Nixdorf Computer Limited has appointed **Mr Malcolm Kaye** as UK sales manager, automotive systems, responsible for sales of Nixdorf's COMET Motor Plus motor dealer systems throughout the UK. He will be forming a sales team which will liaise with car manufacturers to obtain endorsements and sell direct to individual dealers.

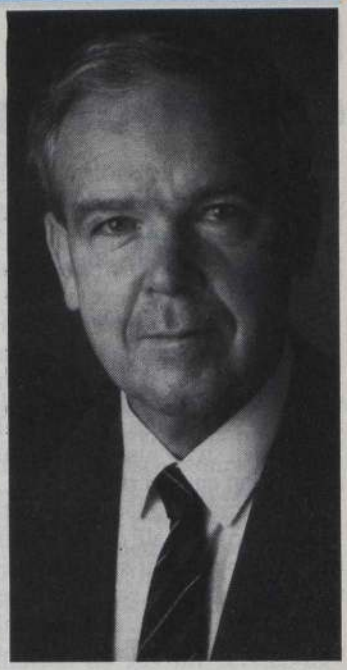
After 10 years' service as Chairman of the Energy Committee of the House of Commons **Sir Ian Lloyd** has been succeeded in the chair by **Dr Michael Clark**.

ProMicro Limited have announced the appointment of **Mr Michael Watts** as project manager. ProMicro, founded in 1981, is a specialist in the design of real-time microcomputer-based data acquisition and supervisory software for the petrochemical and process industries.

Arthur D Little, the international management consultancy, is dividing its London Energy Group into two sections: London Petroleum Group headed by **Mr John Wood-Collins** as Managing Director and London Chemicals Group with **Mr Eric Leon** as Managing Director. These two sections will remain part of Arthur D Little's Energy Directorate along with the Energy Economics Section in Cambridge and the Houston Energy Group although the London Chemicals Group will continue to be part of the European Chemical Practice.

Ramtek Corporation, a leading manufacturer of high performance graphics and imaging display systems, has announced the appointment of **Mr Mike Tyler** as Vice President Marketing.

Tuskar Resources Plc announced the appointment of **Mr Frank Traynor** as Group Finance Director. Mr Traynor is currently Group Managing Director of Silvermines Group Plc.



Mr Bob Reid, at present Chairman and Chief Executive of Shell UK, has been appointed Chairman of British Rail. After 33 years with Shell, he is joining the British Rail Board as Chairman-Designate on 1 January. He will work full-time in his new job from 1 October, on his retirement from Shell.

Mr Keith Bagot, above, a Marine Superintendent working with Star Offshore Services and Trident Offshore has become the first UK National Oil Industry Golf Champion. The tournament organised by The London Oilmen's Golf Association, supported by the North Sea Petroleum Golf Association and Aberdeen's Oil Capital Golf Association is set to become an annual event.

Mr Edward Osterwald has joined Chem Systems International Ltd to help develop the firm's petroleum industry consulting practice. Mr Osterwald previously spent several years with Mobil in the US focusing on industry economics and international supply operations.

Sir Philip Jones, above, Chairman of the Electricity Council, has been appointed to the Board of Total Oil Marine Plc.

Honeywell $3.7 million contract to USSR

HONEYWELL'S joint venture in the Soviet Union, STERCH (CTEPX), has received a $3.7 million contract from the Soviet Ministry of Oil and Petrochemicals.

Under the agreement, Honeywell will provide a TDC 3000 industrial automation system to be installed in a petrochemical plant in Perm near the Ural, about 1,900 miles east of Moscow. Honeywell will also supply associated application engineering.

The contract was signed with the Soviet Ministry on behalf of Permnefteorgsyntez, for a plant that supplies ethylalcohol to a large pulp and paper complex.

Delivery of the system and related equipment is scheduled for later this year, with production start-up by March 1991. STERCH was responsible for the technical planning and negotiation of the sale; Honeywell's Austrian affiliate provided technical expertise.

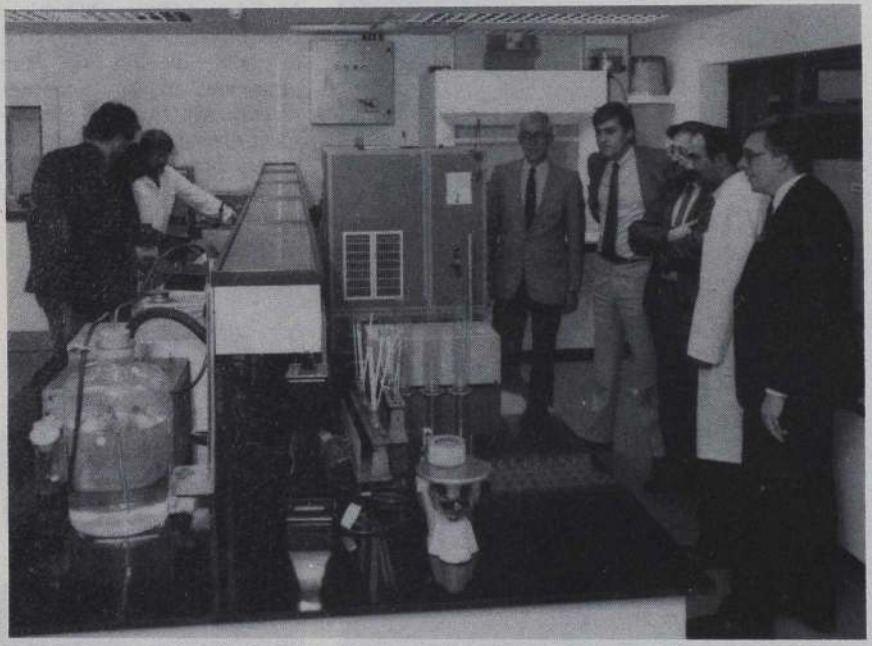
STERCH was formed in 1988 between Honeywell and the former Soviet Ministry of Mineral Fertiliser to supply industrial process control systems for fertiliser plants in the Soviet Union.

Honeywell has a 49 percent ownership in the joint venture and provides management expertise and products. Its Soviet partner, Agrochem, a newly-formed trust, that replaces the Ministry of Mineral Fertiliser, owns 51 percent. Agrochem provides some technical expertise, facilities and most of the personnel.

World's smallest centrifugal compressor

INGERSOLL-RAND has produced the world's smallest packaged centrifugal compressor. The new CVO series of Centac compressors is based on a new air end design of two-stage centrifugal compression, to provide totally oil-free air from 10.5–18.0 m^3/min (350–600 cfm).

Extensive aerodynamic and mechanical research has led to this new industry achievement, say the company. It allows the use of centrifugal compressors in smaller industrial applications where air demands have been too low to warrant their use previously.



Ali Salhan and Arnie Gregson demonstrate the use of test equipment in Moore Barrett and Redwood's new laboratory at Immingham, South Humberside. The laboratory, which is equipped to test petroleum products, petrochemicals and gases, is part of an enlarged laboratory/office complex which was officially opened by Peter Schaad, managing director of SGS in the United Kingdom on 15 November 1989.

An 'open day' for the new laboratory was very well attended by representatives from oil companies, traders, storage and transport companies and local businesses.

PL aquagel-OH

THE PL Separation Sciences division of Polymer Laboratories announce the launch, this month, of a new polymeric aqueous GPC packing material, PL aquagel-OH.

This rigid macroporous matrix has a hydrophilic surface, and has been developed with a range of controlled, reproducible pore sizes and pore size distributions suitable for the analysis of a wide range of synthetic water soluble polymers.

The materials are all mechanically stable to 3,000 psi and will be available in three pore sizes.

New downhole company

A NEW company has been established in Aberdeen to provide permanent systems, which permit continuous bottomhole pressure and temperature data acquisition of platform, subsea and satellite wells, for the purpose of oil and gas reservoir evaluation.

The new company, Exal-IPR Ltd, is a joint venture between the electronic data measurement and sampling services company, Exal and IPR Services A/S, part of the Smedvig Group.

Phillips onstream

PHILLIPS 66 Company has announced that it expects to be producing polyethylene again at its Houston Chemical Complex which was destroyed by an explosion and fire last October.

A new plant with a rated capacity of £300 million is scheduled to come on stream in June, with an approved expansion of the new plant adding another £300 million in late 1990.

Sulzer pumps for Norway

SULZER (UK) Pumps of Leeds has won a £1 million contract to supply two large pumps for the Norwegian sector of the North Sea.

The contract was awarded by Kvaerner Engineering of Oslo on behalf of A/S Norske Shell, for installation on the new Draugen Field Development. Delivery is scheduled for July.

Aramco package

THE OIL and Gas Division of the metering pump manufacturer Bran + Luebbe has been awarded a contract worth in excess of £100,000, to supply high pressure methanol and corrosion inhibitor injection packages to Saudi oil and gas producers, Aramco.

New total instrumentation package from Rosemount

ROSEMOUNT has launched the PetroCount™ Inventory Management System, PIMS, a microprocessor-based batching control product for automating custody transfer operations in petroleum distribution terminals.

Five UK orders totalling £500,000 have already been booked, including systems for supplier Murco and distributor Thames Matex. It was first introduced in the United States.

PetroCount IMS, which is cheaper and more accurate than its predecessor, is designed to replace existing manual/mechanical methods of loading liquid petroleum products onto road or rail tankers. It incorporates many advanced features for making operations more efficient and for improving stock control and accounting.

It can operate either in a stand-alone configuration — where each PIMS controls one loading station — or be used in networks. It can also be interfaced directly with a supervisory or management information computer.

PIMS is designed to work in conjunction with other Rosemount products, including pressure, density, mass flow instruments and valves and can form part of an overall tank farm management system utilising the Rosemount Varec range of tank farm products.

The PetroCount IMS system, incorporating three microprocessors, offers a high degree of automation potential in one easy-to-install package. Additional modules are to be launched next year to increase flexibility. Specialised software can be supplied to interface PIMS with other computer systems, enabling distribution operations to be integrated easily into company-wide accounting and management information systems.

PIMS incorporates all the features needed to allow drivers to gain access to a loading station, input order details, select batching requirements and initiate invoicing themselves. Thus, all functions are under the control of the tanker driver, resulting in faster throughput of vehicles and a minimum of on-site supervision. The system can work in either top or bottom-loading systems.

In addition, after five years development work, Rosemount has reaffirmed its technology leadership in the direct mass flow marketplace by becoming the first company to break the high temperature barrier for Coriolis-effect direct mass flow sensors.

Micro Motion's new 'DT' range is capable of reliable, accurate operations at up to 426°C. The normal Micro Motion accuracy of ± 0.2 percent can be achieved over the full operating temperature range.

Rosemount's new PIMS.

Rosemount believes that the marketplace for high temperature direct mass flow measurement is up to 20 percent as large overall as the existing 'low-temperature' one, and possibly up to 50 percent in some markets.

The 'DT' range of sensors is available now in three flow sizes, each capable of measuring mass flow, temperature, density and totalised flow up to the maximum operating temperature. The devices do not need any purging or cooling, they can be operated in ambient conditions of up to the same maximum and they can be subjected to localised heating (e.g. steam tracing) over the same range.

Micro Motion introduced the first Coriolis-effect direct mass flow meter over 10 years ago and has sold nearly 80,000 units worldwide, representing about 90 percent of the installed market.

$88 million in Cooper Rolls orders

COOPER ROLLS has received orders valued at over $88 million for 10 Coberra gas turbines to be installed in natural gas storage, lift, transmission and reinjection services. Of the 10 new units, three will be installed on offshore oil and gas production platforms.

Eight Coberra 6000 gas turbines are included. Two Coberra 2000 units have also been ordered, each comprised of a Rolls-Royce Avon gas generator and Cooper-Bessemer RT56 power turbine. All 10 units are scheduled for delivery between March and June.

The Dubai Petroleum Company has ordered two Coberra 2000 gas turbines for installation on gas lift service offshore Dubai in the Gulf.

For gas reinjection service offshore Australia, Nuovo Pignone has ordered a Coberra 6000 gas turbine on behalf of Woodside Offshore Petroleum Pty Ltd. The unit will be installed on Woodside's Goodwyn 'A' platform in the Indian Ocean, and marks the first Coberra gas turbine to be installed offshore Australia.

Seven Coberra 6000 units have been ordered by two major gas transmission companies in Canada, NOVA Corporation of Alberta and Union Gas of Canada Limited.

Manufacture of the Cooper Rolls equipment for Dubai Petroleum Company, NOVA and Union Gas will take place at its Mount Vernon, Ohio (USA) facility. The unit for Woodside Offshore Petroleum Pty Ltd will be manufactured at Cooper Industries' Bootle (England) plant. The gas turbines will be supplied from Rolls-Royce manufacturing locations in the United Kingdom and Canada.

Shell's SuperCluster transputer array

SHELL Research is to install industry's largest transputer array in its Dutch facility. The system is a SuperCluster manufactured by German parallel computing specialists, Parsytec, who won the Shell contract in the face of stiff competition. Amongst its prime tasks will be complex fluid flow simulation with diverse oil and gas industry applications.

The system will become operational this year, and includes 400 Inmos transputers — capable of performing 600 million floating-point calculations every second. Data storage capacity will be 800 Mbytes of random access memory — with error correction to guard against software errors during long calculations.

Initially, the Parsytec supercomputer will be used for research into fluid flow simulation, using a technique known as cellular automata. This is especially suited to modelling flow through porous media, for example in catalyst beds and oil reservoirs.

The supercomputer could also be used for optimising chemical plant operations, seismic analysis and modelling the hydraulics of offshore structures.

Ferranti forecourt for Safeway

FERRANTI Industrial Electronics Limited (FIEL) has successfully completed a contract for the design, installation and commissioning of the petrol forecourt at the new Safeway superstore at St Helens, Lancashire. The contract, awarded by Argyll Stores, included the supply of tanks, pipework, gauges, fuel pumps and the in-kiosk controller.

Five 10,000 and one 6,000 gallon Glass Reinforced Plastic (GRP) tanks supplied by Ferranti Resin Limited were installed. Compared with the usual mild steel, GRP tanks are light and easy to handle and, as the tanks are corrosion-free, installation is much more straightforward. Exterior concrete cladding is not required.

For speedy customer throughput, Safeway chose the latest quad fuel dispensers from the Ferranti International 8000 series. Under a separate contract FIEL will provide a comprehensive seven days a week maintenance service, for all the forecourt equipment at St Helens. This is the first complete Safeway site development undertaken by FIEL.

Pipelining championship

A FAST, efficient technique for re-lining gas and water mains has won a national award for Subterra Limited.

The company's rolldown pipe system won the 1989 Castrol Multiplant/Construction News R&D Awards, presented by Sir Gordon Brunton, former chairman of the NEDO civil engineering research and development committee.

The rolldown pipe system uses the latest 'shape memory' materials technology. Polyethylene pipes are fed between rollers to reduce their diameter, so that they can easily be slipped inside existing mains. When water pressure is applied, it triggers the 'memory' of the polyethylene, which then tries to return to its original diameter, thus holding itself in a close fit position inside the main.

Because of the low frictional properties of the polyethylene, the lined main will actually have a greater capacity than the original.

Subterra developed the Rolldown technique in conjunction with Stewart and Lloyds Plastics Limited, and BHRA, The Fluid Engineering Centre.

New seismic umbilical design wins repeat orders

REPEAT contract for two new-design, field-proven seismic umbilicals has been awarded to Jacques Cable Systems Ltd of Cambridgeshire, by survey company Halliburton Geophysical Services International Ltd (HGS).

According to HGS, the air gun umbilicals designed and manufactured by Jacques are slimmer without impaired strength, and incorporate design details which enhance system efficiency.

A field-proven air gun umbilical, from Jacques Cable Systems, about to be deployed for a seismic survey by Halliburton Geophysical Services Ltd (HGS).

John Brown to upgrade gas lift

JOHN BROWN, a Trafalgar House Company, has been awarded a contract for design engineering services by Sun Oil Britain Limited for their Balmoral field.

The contract involves upgrading of existing gas lift facilities on the Floating Production Vessel in the Balmoral Field. Specification and detailed design for installation of the new facilities are aimed at enhancing production operations and minimising offshore works. A tight design programme is required to ensure rapid initiation of procurement activities.

The work will be carried out by John Brown's office in Aberdeen and is scheduled for completion in the late spring.

Bacteria in oils

A BRITISH company with an international reputation for testing for bacteria in medical and catering applications, has now developed a test suitable for industrial use.

Tillomed Laboratories of Henlow, Bedfordshire, has extended its range of diagnostic culture slides to include identifying bacteria in oils and fluids in industrial machinery. Such infections, says Tillomed, not only constitute a health hazard to the machine operator but biodegradable oils, contaminated by a bacterial infection, can lose their lubricant properties, thus damaging valuable machinery and equipment.

Tillomed's culture slides are used on site. There is no need to take samples for laboratory analysis and results are evident only 24 to 48 hours after testing.

Pipeline maintenance

A MAJOR new tool is now available for underwater pipeline and cable maintenance, instrument recovery, salvage, archaeology, locating and marking. The 1090J Acoustic Valve Operator allows control from the surface of air, hydraulic, electrical and mechanical devices underwater. A typical example would be the inflation of a liftbag.

Advantages of the 1090J are that it can be handled by one person from a small boat; remotely operated by a secure acoustic signal and operated at depths to 26,000 feet. Many controllers can be operated with one command unit and no diver is required for recovery of the subsea valve operator, which is completely reusable.

New policy for IP Information Service

The IP provides a very comprehensive information service to its members, the general public, media and staff, answering more than 12,000 enquiries per year, producing and distributing educational material and statistics and selling IP publications.

It has available a wide range of resources to facilitate provision of the service and a team of expert staff. These facilities are freely available to members who may spend time researching in the Library and receive advice and assistance from the staff.

As from 1 January 1990, there will be a change of policy for non-members wishing to use the service — the main features of which are outlined below.

The department will endeavour to answer all enquiries from members, general public, media etc. provided they can be answered within 15 minutes.

Enquiries which require lengthier research will incur charges according to a two tier system, whereby members pay considerably less than non-members.

Access to all the Information facilities will be freely available only to members who may use the resources and be assisted by the staff.

Collective membership extends many of the facilities to employees of the company.

Non-members wishing to use the Library will be admitted at a rate of £10 per day and £5 per half-day.

Loans of books are granted only to individual members or to employees of companies who are collective members.

Students will be allowed to use the facilities on production of a valid student card and will be allowed to borrow books on production of a letter of guarantee from their tutor.

Services offered

The following is a selection of some of the services that the department provides:

IP Statistics available on annual subscription

The Institute produces a range of regular statistical publications which give valuable facts and figures relating to the oil industry. The subscription service entitles subscribers to receive the quarterly and annual *Consumption and Refinery Production* figures (for the UK, Scotland and Northern Ireland), the annual booklet *World Oil Statistics*, the *IP Statistics Folder* and a complete set of *Oil Data Sheets* with regular updates. Mailings are carried out quarterly. Price £20 per annum (UK & Europe), £25 (Overseas).

Press Monitoring Service

If you need regular, up-to-date oil industry information on a specific subject or on specified companies or countries, the IP can provide press cuttings in weekly batches to keep you informed.

Search Service

Online and manual sources are used to provide searches in response to technical, market research, commercial and business enquiries. Staff have particular expertise and knowledge of external oil-related databases. All enquiries are treated with complete confidentiality.

Telerate

The Telerate screen, based in the Library, provides on the spot price and oil news information and is available for use by members.

Job Opportunities

Those looking for employment might benefit from a visit to the Library to consult the employment opportunities package. This gives details of vacancies clipped from the main daily newspapers, lists of recruitment agencies, lists of companies and educational courses. Many industry journals are also available for consultation.

Topcat (Library Catalogue Database)

The inhouse database which holds the library catalogue contains nearly 1,200 records of publications added to the collection over the last two years. It provides quick and easy retrieval of records by author, organisation, subject classification or by words in the title. Reading lists on particular subjects can be provided.

For further details of any of these services please contact Catherine Cosgrove, Pamela Russell, or Jean Etherton on 01-636 1004.

Charges

Photocopies	
Members	15p per page
Non-Members	30p per page
Students	10p per page
Fax Transmission (UK)	
Members	£3 plus 80p per page
Non-Members	£5 plus £1 per page
Hourly rate for staff time	
Members	£20 per hour
Non-Members	£40 per hour

All charges are subject to VAT at 15 percent

Technical Report

Marketing and Refining

A very successful International Aviation conference was held in October.

A Code of Practice for the development of a response plan for serious incidents involving petroleum product road tankers has now been published.

An exemption certificate has been issued by the HSE to permit road tankers to be built to the IP updated design standards. These standards are currently in draft form and it is proposed to publish these as an HSE document. The complete Road Tank Wagon Design Code is being proposed by BSI for consideration as a CEN standard.

The final draft of the electrical code has been prepared and will shortly be circulated to the Engineering Committee, HSE, and other interested parties.

The high level cut off compatibility document for road tanker loading has now been agreed and will be published.In addition, a revision to the existing IP Bottom Loading Code will be made.

Following the endorsement of the 1990 research budget, a safety project, the testing of aviation hydrant valves to determine their effectiveness in emergency conditions, has been commissioned.

The Petroleum Measurement Manual Guide to Gas Metering Systems has been published.

Comments on the Area Classification Code have been received from the HSE and have been incorporated into the final draft document. The code has now been forwarded to the printers for publication next year.

Standardisation and Measurement

The 1990 edition of the Standard Methods for Testing of Petroleum and Related Products is scheduled for publication in March. This edition includes the first four methods to be published in ISO format and is the start of a programme to have the majority of methods in ISO format within the next three to four years. In addition, permission has been obtained to publish some ISO test methods with suitable acknowledgement.

It is proposed to develop a quarterly Standardisation News section for *Petroleum Review*, providing information on existing and new test methods, reports of meetings attended by IP members and other areas of interest. The first edition is scheduled for the February issue of *Petroleum Review*.

Occupational Health

A six monthly progress meeting of the epidemiology study steering group took place at the Institute. Progress has been satisfactory, with the study now in the data collection phase.

A well-attended and lively conference on exhaust gases — environmental & health effects was held on November 22. Some of the points made were misquoted by the press and effort was devoted to correcting this.

Education and Training

The third draft of the Drilling and Production Safety Code has been produced and sent out for comment, with a recommendation that this edition be published without waiting for fully agreed actions arising from the Cullen inquiry.

The high pressure well control code of practice remains at the information gathering stage. Little can be done by the Institute to accelerate matters, as neither the UKOOA worst case scenario curves or the signed contract with the Department of Energy have been received.

The IP led a UK delegation to an ISO/TC67 Advisory Group meeting on Materials and Equipment for the Petroleum and Natural Gas Industries.

A successful one day conference on Cost Reduction Offshore was held in November.

Exploration and Production

A presentation of the MORI survey was made in November to senior industry line and personnel executives. This survey was commissioned by the IP on the career intentions of final year undergraduates, particularly with regard to the oil industry. Possible future activities were reviewed.

A workshop for Training Managers on 'Standards of Competency' was also held in November.

Other Meetings

An early November meeting took place with DGMK, IFP, and CONCAWE to co-ordinate oil industry research activities, prior to the presentation of IP proposals to the OILC committee.

AEH Williams, Director General

Institute News

Ray Clinton, left, chairman of the IP Irish Branch, talking to Robert Molloy, Irish Minister for Energy, and Peter Sutherland, Director of BP Oil Ltd and Chairman of Allied Irish Banks plc, at the branch's annual dinner on 16 November 1989.

In his speech, Mr Clinton threw down a challenge to the downstream side of the industry to develop better communications with the government. No one company, he suggested could do this of its own accord.

Therefore it was essential that the development of good communications should be approached from a sectoral standpoint, and then that it be carried through in a regular and sustained way.

He went on to contrast how the upstream side had become much more adept and successful at establishing effective and open communications with the government.

He said, 'Bearing in mind the good track record of the industry over such areas as technological leadership, health and safety, training and the quality of employment, surely it was only right and fair that the voice of the downstream side should be heard a little more often, so as to give balance and perspective to the all too frequent negative coverage of this significant side of the industry.'

New Members

Students

Kelly, MJS, Ground Floor Flat, 16 Camden Crescent, Bath, Avon BA1 5HY.

Langridge, Miss NE, 28 Bath Road, Southsea, Hants PO4 0HT.

Student Prizewinner

Smith, AP, Conoco (UK) Ltd, Rubislaw House, North Anderson Drive, Aberdeen AB2 4AZ.

Around the Branches

Aberdeen

9 Jan: 'Oil Based Mud and the Environment', by Chris Meyjes, MGA Consultancy Services.

Edinburgh & South-east Scotland

18 Jan: 'Environmental Aspects of the Wytch Farm Development', speaker to be confirmed.

Essex

10 Jan: 'Transportation of Dangerous Substances from a Police Viewpoint', Sgt Bottrill, Essex County Constabulary.

Humber

18 Jan: 'Petrofina Pipeline Project' speaker J Peder Baner, Project Manager, Petrofina UK.

London

17 Jan: 'Coal and the Environment', JS Harrison, Coal Research Establishment.

Midlands

17 Jan: 'The influence of unleaded petrol and of the forthcoming exhaust emission regulations on engine lubricant design', Mr J Hillier, BP.

19 Jan: IP/BLF Dinner Dance, Park Hall Hotel, Wolverhampton.

Northern

16 Jan: 'Gear Oils', speaker to be announced.

South Wales

16 Jan: 'Project Management', LA Taft, Inco Europe. BP Oil Llandarcy Refinery.

25 Jan: 'The Impact of Environmental Legislation on European Refinery Economics', PA Hunt, Chem Systems International Ltd. Venue: Stradey Park Hotel, Llanelli.

Stanlow Branch

24 Jan: Annual General Meeting followed by 'The Shell HYCON Process', J Naber, Shell International Petroleum. Venue: Shell Thornton Research Centre.

Yorkshire

9 Jan: 'Introducing BS 5750 into Lubrication', B Squires, Total Oil (GB) Ltd.

Deliveries into Consumption

UK deliveries into inland consumption of major petroleum products — Tonnes

Products	*Oct 88†*	*Oct 1989**	*Jan–Oct 1989†*	*Jan–Oct 1989**	*% change*
Naphtha/LDF	219,970	325,250	2,675,510	2,701,950	+1.0
ATF—Kerosine	556,480	594,570	5,266,800	5,611,380	+6.5
Motor Spirit	1,962,190	2,042,320	19,289,410	19,934,260	+3.3
of which unleaded	32,546	561,365	146,136	3,513,175	+2304.0
Burning Oil	184,040	159,630	1,540,320	1,464,590	−4.9
Derv Fuel	829,540	901,960	7,755,600	8,399,650	+8.3
Gas/Diesel Oil	727,000	681,860	6,891,220	6,809,880	−1.2
Fuel Oil	1,204,910	1,056,200	8,766,930	8,177,010	−6.7
Lubricating Oil	71,540	74,930	715,830	741,800	+3.6
Other Products	537,670	510,700	5,762,690	5,426,000	−5.8
Total above	6,293,340	6,347,420	58,664,310	59,266,520	+1.0
Refinery Consumption	419,210	455,300	4,508,970	4,816,510	+6.8
Total all products	6,712,550	6,802,720	63,173,280	64,083,030	+1.4

*Preliminary †Revised

Advance notice

EXPLORATION AND PRODUCTION DISCUSSION GROUP

A New Look at Offshore Safety

A one-day conference
to be held at the Cavendish Conference Centre

Thursday 22 November 1990

Safety has always been a crucial matter in the potentially hazardous offshore oil and gas environment. After a steadily improving operating safety record over the last decade, recent tragic events have focused public attention on North Sea operations.

The conference will examine this important subject in the light of new recommendations and their impact on future offshore oil and gas operations, procedures and economics.

For further information please contact **Caroline Little,** The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Telephone: **01-636 1004**. Telex: **264380**. Fax: **01-255 1472**.

SITUATION VACANT

IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

The College is seeking to fill with immediate effect a Lecturer/Senior Lecturer post under the New Academic Appointments Scheme in the Department of Mineral Resources Engineering. The Department has around 100 undergraduates and some 85 postgraduates engaged in advanced study courses or research.

Candidates for the post should have a good first degree in an engineering or science discipline and a further qualification in Petroleum Engineering or Mining Engineering and/or relevant research experience. A record of innovative ability in Industry would also be advantageous. The research interests of particular significance include either Petroleum Reservoir Engineering, Quarry Engineering, Geostatistics and Reserves Estimation or Management in the Minerals Industry.

Further particulars and/or applications with full CV and publications list should be addressed to the Head of Department MRE, Professor John Archer at ICSTM, LONDON, SW7 2BP by the 15th January 1990.