PETROLEUM REVIEW

January 1991 Volume 45 Number 528 £5.00

Subscription (inland) £50.00 (overseas) £62.00

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 Robert Horton, Chairman, BP plc, by Jon Whitbourne.

Met 'oil desk' opens

One of Europe's most advanced commercial weather forecasting systems is now in place providing round-the-clock information to the North Sea oil industry. A specialist 'oil desk' to serve the industry was inaugurated last November by Scottish Office minister Lord Strathclyde at the Met Office's Weather Centre in Aberdeen.

The MIST system in use at the centre is one of the most sophisticated available. It was originally developed for the RAF to give real-time on-screen weather information direct to the pilot, and was later adapted to meet the needs of North Sea helicopter pilots.

The Aberdeen system is linked directly to the equally sophisticated COSMOS system at Met Office headquarters in Bracknell, the most powerful numerical forecasting suite in the world.

The Aberdeen Weather Centre is now the focal point for all metereological services to oil and gas operators on the UK Continental Shelf.

Speaking at the inauguration ceremony, Lord Strathclyde stressed that oil and gas production is now certain to last well into the next century, and pointed out that, with the launch of the first Frontier Licensing Round last year, companies could soon be operating in much deeper waters to the north and west of Scotland.

He said it was this long-term forecast which had prompted the opening of the oil desk in Aberdeen, as opposed to London, where the Met Office have provided information to the industry for the last 25 years.

The move to Aberdeen is seen by many as a logical and long-overdue step, and one which will allow companies to plan their operations days in advance, as the specialist team at Aberdeen will provide highly accurate forecasts geared precisely to the needs of the industry.

The facility will also provide improved weather forecasting services to other industries, such as fishing, shipping and agriculture.

The Head of Aberdeen Weather Centre, Mr Hugh Cumming, said 'We expect forecasts and other services to the area to be even better now. We have seen a lot of our advances in our 50 years in Aberdeen, but I could only have dreamed of the facilities we now have at our fingertips.

Repsol sign Soviet agreements

Repsol Exploración has signed two protocol agreements with the Ministry of Geology of the Soviet Union, which controls mineral resources exploration in the USSR.

The first of the agreements, with the Turkmenian Institute for Geology (a subordinate entity of the Ministry of Geology) is the basis for co-operation in evaluating two large oil and gas areas in the Republic of Turkment.

The other agreement, is aimed to set up more specific exploration and production projects in the Soviet Union. It also considers the opening of a Repsol branch office in Moscow.

These agreements represent a significant step for Repsol in its access to the USSR at a time when important possibilities are being opened for Western oil companies.

The USSR is the largest oil producing country in the world. In 1989 it produced 12.5 million barrels per day, representing 19 percent of the world production. It is followed by the United States with 14 percent and by Saudi Arabia with 8·3 percent of world production.

Amoco order

Amoco has announced a £53 million order for new gas fields development. Highlands Fabricators (Hi-Fab) of Nigg, Easter Ross, will build three jackets for the Everest and Lomond gas fields development in the Central North Sea. The gas will be transported by the 36 inch diameter, 247 mile Central Area Transmission System (CATS), which Amoco, is to build from the Central North Sea to Teeside.

The order to Hi-Fab is for three steel jackets, one platform jacket each for the North Everest and Lomond fields, and a riser jacket which will be located at North Everest. Delivery is scheduled for April 1992.

British Gas deadline

The gas marketing branches of oil companies such as BP, Conoco, Esso, Mobil and Shell, could gain a more significant share of the industrial gas market thanks to OFGAS, the industry's watchdog.

In a statement designed to encourage more competition, Mr James McKinnon, Ofgas's Director General, reminded British Gas that it must surrender 30 percent of the market by October 1993 — a deadline set by the recent Monopolies and Mergers Commission report.

Mr McKinnon warned if BG failed to meet the deadline the whole structure of the gas industry may have to be reconsidered by the MMC, possibly leading to the break-up of BG into regional concerns, with the selling off of the company's transmission network.

Currently independent gas firms share only 2 percent of the market. To achieve the MMC deadline, they will have to build up their levels of supplies gradually — 400 million therms this year, 800 million therms in 1992 and 1.2 billion therms in 1993.

New test well

Aberdeen's International Drilling and Downhole Technology Centre's (IDDTC) first well, the most advanced vertical well of its kind has been completed at 4,900ft, providing the industry with an unique and risk-free opportunity to study and develop new techniques and equipment including those for blowout and kick control.

Vietnam well

Enterprise Oil has announced that its well 17-C-1X being drilled offshore south of Ho Chi Minh in Vietnam has produced oil. The oil has similar properties to that in the nearby Bach Ho (White Tiger) field. During test the well flowed at production rates of around 300 barrels of oil per day. The well has been suspended while the company considers whether the production rate should be stimulated.

Mobil gas

Mobil have bought the entire gas reserves of the Scott field in the North Sea — a first for a direct competitor to British Gas in the industrial gas market.

The Scott field is due to come on stream in 1994, building up to an expected peak production of 90 million cubic feet per day soon afterwards. Total gas reserves have been estimated at more than 200 billion cubic feet.

Elf discovery

Elf Aquitaine have made an important discovery on the south-east border of Nigeria. The amount of reserves is yet to be announced until approval is given from the Nigerian authorities, but it is reported that the well is producing 3,000 barrels a day of good quality light crude.

Schlumberger buy-out

Schlumberger Technologies Ltd has acquired Dundee-based petrol pump and systems manufacturer Dunclare Dispensers in a deal which places the multinational at the top of the European retail petroleum market.

As the deadline for the single European market draws closer, the Retail Petroleum Systems Division of Schlumberger has increased its market share by buying the total equity of Dunclare, Europe's largest independent.

Dunclare joins some distinguished company as Schlumberger has already snapped up French firm Aster-Boutillon, Koppens Automatic of Benelux and more recently Schwelm Tanksysteme of Germany in a low profile build-up to 1992.

Despite the takeover, the Dunclare name will not disappear, for Schlumberger operate a 'national unit' policy which will not only leave the Scottish firm's management intact but also give it a degree of autonomy within the United Kingdom.

Euan Baird, Chairman of Schlumberger, said: 'International solutions can be found through national organisations and we believe that it is only by developing a multi-racial culture inside our company that we can contribute fully to the successful implementation of new technology worldwide.'

Dunclare Chairman and Managing Director Bill Peet was optimistic about the merger. He said: 'We do not underestimate the tasks and the problems that face Dunclare in the future but we are now in the best possible shape to grasp the opportunities, solve the problems and implement the policies that will give our customers the support they expect, on an international basis.'

Oilman's honorary degree

Mr James Hay, the Aberdeen-based General Manager of UK Operations, BP Exploration, has been awarded the Honorary Degree of Doctor of Technology by Robert Gordon's Institute of Technology (RGIT), Aberdeen.

Mr Hay, who graduated from Aberdeen University with Honours in Geology is a Governor and past chairman of the Board of Governors of RGIT. He is chairman of the Institute of Petroleum, Exploration and Production Committee and a member of Aberdeen Beyond 2000 Executive Committee.

East Brae plan

John Wakeham, Energy Secretary, has announced his approval of the Brae Group's Development Plan for the East Brae Field. Operated by Marathon Oil UK, East Brae is located in Blocks 16/3a and 16/3b, some 165 miles northeast of Aberdeen. The £850 million project will supplement the Brae Group's existing North, Central and South Brae developments which are already in production.

Canadian vote

There was good news for Atlantic Canada. Federal assistance for the Hibernia offshore Newfoundland oil project got final approval in the Canadian Senate.

The upper house voted unanimously to pass a bill approving $2.7 billion in federal loan guarantees and cash for the $5.2-billion megaproject.

Guidelines on farm-ins

John Wakeham, Energy Secretary, has made a statement on policy regarding farm-in proposals for oil and gas exploration and production licences.

In answer to a written Parliamentary Question, Mr Wakeham said: 'Transfers of interest in petroleum licences, which are commonly known as farm-ins, are commercial transactions and as such the arrangements are initially a matter for the companies concerned.

Under the terms of petroleum licences, such transactions also need my prior consent. Like my predecessors, I believe farm-ins have the potential to benefit UK oil and gas exploitation. They enable companies operating on the UK continental shelf to make what they regard as timely and desirable adjustments to their holdings of licence interests, and they are of particular importance to those independents which wish to increase the scale and pace of their participation in exploration and development activity.

In examining farm-in proposals, I shall continue to seek to ensure that the purpose for which licences have been granted — that is the thorough and efficient exploration and exploitation of the nation's oil and gas reserves — is fully safeguarded by the transactions.'

Chevron/Conoco swap

Chevron UK Limited has announced that it has acquired operatorship of Block 29/19a and an interest in Block 3/24b following a Licence Interest Agreement with Conoco (UK) Limited.

Under the agreement, Chevron has acquired Conoco's 25 percent interest in Licence P205, Block 29/19a, giving the company a total interest of 41.66 percent and its 30 percent interest in Licence P268, Block 3/24b. In return, Conoco has received Chevron's 25 percent interest in Licence P205, Block 15/14a and its 20 percent interest in Licence 336, Block 9/12b.

ARCO buyout

Atlantic Richfield has bought out Oryx Energy's interests in the Midway-Sunset onshore fields in Southern California in a deal worth $642 million.

The deal will net ARCO a further 23,000 barrels a day which will bring the company's total oil production in California to a reported 79,000 barrels a day.

. . . news in brief

9 November

LASMO will begin a drilling programme on the Birch field block 16/12a.

Gulf Canada Resources is seeking buyers for up to half its 25 percent stake in the Hibernia offshore oilfield project as part of a major asset disposal programme.

12 November

Pict Petroleum is planning to step up exploration in 1991 and is reappraising oil reserves in its main North Sea operations.

Mobil Oil Corp has agreed to expand its search for oil in the Upper Huallaga Valley, Peru.

13 November

Partners in the Australian North West Shelf LNG project have agreed to increase deliveries to its eight Japanese utilities customers.

Saga petroleum is negotiating to buy all or part of the Norwegian Oil Consortium estimated to be worth between NKr 3.6 bn and NKr 4.6 bn.

14 November

Mobil Corp said its Mobil Corp AG have sold the 100,000 b/d refinery at Wilhelmshaven to Bulk Oil AG and the Dreyfuss Group.

Clyde Petroleum has agreed to acquire British Petroleum's exploration and production assets in the Netherlands for £68m.

15 November

Italy's Gasenergia SPA and Miguel Angel Gonzales Redondas SA of Spain have formed a 50:50 joint venture in Spain called Gasenergia Iberica SA and will be involved in the construction of gas transmission systems.

The US Federal Energy Regulatory Commission gave its approval to the US portion of the proposed Iroquois gas transmission system, which involves an underground pipeline running from Iroquois, Ontario to Long Island, New York.

16 November

BP and Elf plan to complete the appraisal of the Clair field with two wells in 1991.

ENI are in advanced talks with Qatar to jointly produce LPG.

Spain is negotiating a new energy supply agreement with France that would double the amount of electricity Spain receives from France to 2,000 MW from 1,000 MW a year.

19 November

Idemitsu Kosan Co Ltd has announced that it will begin oil production offshore Japan — the oil well is in a field estimated to have about 188m barrels of reserves.

20 November

Under a licence interest exchange agreement, Chevron has acquired Conoco's 25 percent interest and the operatorship of block 29/19a.

Petroleum spending off Canada's east coast could reach C$10 bn by the turn of the century with the development of at least two oil fields near the recently announced Hibernia project.

21 November

Beau Canada Exploration Inc and Claude Resources Inc have completed an agreement with Amoco Canada Petroleum Co and its managed partners for the purchase of Amoco's Twining oil and gas properties for C$27.5m.

Chevron Chemical Co is actively soliciting offers for its fertilisers business.

22 November

Total and the French Atomic Energy Commission are testing a revolutionary new device which dates sedimentary rocks needed in oil exploration.

23 November

Elf Aquitaine said its Elf France SA subsidiary has agreed to purchase two French petroleum product companies that will boost Elf's share of the domestic product distribution market to about 20 percent from 14.3 percent currently.

Austria's state controlled oil group OMV AG said it was expanding its petrol station network in Eastern Europe through a joint venture with Czechoslovakia's Benzinol.

26 November

A subsidiary of Royal Dutch/ Shell has discovered new oil and gas deposits off Brunei.

Chevron Corp has agreed to increase supplies to Zaire's oil refinery to end the fuel crisis and build up the country's strategic reserves.

27 November

Mobil Exploration Australia Pty Ltd has farmed into a vast, largely unexplored area of the Timor Sea, 800 kilometres west of Darwin, to expand its oil and gas exploration in Australia.

28 November

Amerada Hess has agreed to sell all the gas from the Scott field directly to Mobil Gas Marketing in what is said to be the first deal of its kind not involving British Gas.

Woodside Petroleum Ltd has agreed to buy BP Developments Australia Ltd's entire 10 percent interest in permit WA-1-P offshore Western Australia for $4.4m.

Shell has announced a major exploration success with a high-pressure well drilled beneath the Champion field.

29 November

Marathon has been given the go-ahead by the UK Department of Energy for the £150m development of the East Brae field.

Shell Canada Ltd intends to sell selected coal assets operated by its wholly-owned subsidiary Crowns Nest Subsidiary Ltd, for an undisclosed price.

BASF AG' energy subsidiary of Wintershall AG' said that together with its Soviet joint venture partner Zarubeshgas, it has signed an agreement with the Soviet Union to supply about 6bn cubic metres of natural gas to eastern Germany annually.

Arco is to pay $642m to acquire a portion of the Midway-Sunset onshore oil interests in Southern California.

30 November

AGIP has won the go-ahead from the UK Department of Energy for the development of the Toni field in block 16/17.

Shell Canada Ltd plans a C$40m enhanced oil recovery project at the Midale oil field in south eastern Saskatchewan.

Elf Aquitaine said a well off the south east coast of Nigeria tested 2,200 to 3,000 b/d of good quality anhydrous crude oil.

Chevron Corp has been granted an oil exploration licence in Yemen, in partnership with the Yemeni government. Under the 20-year renewable licence, Chevron was granted exploration rights in block 3 in the Shabwah Valley, of the blocks to be relinquished by a Soviet concern.

3 December

The UK government has agreed to pay £400,000 towards the legal costs incurred by two unions during the year-long inquiry into the Piper Alpha disaster.

Shell is planning to spend about £1 billion on upgrading its UK North Sea platforms.

4 December

British Petroleum has ruled out large acquisitions to avoid further strain on its balance sheet but is expanding operations in the Far East.

Papua New Guinea announced the go-ahead for the country's first commercial oilfields. The production licence has been granted to an international consortium to develop the Iagifu/Hedinia and associated fields in the southern highlands of western PNG.

The offshore industry's response to Lord Cullen's recommendations

By Dr Harold Hughes OBE,
Director-General, UK Offshore Operators Association Limited

UKOOA represents the 36 companies exploring for and producing oil and gas on the UK continental shelf. As Director-General, I am responsible among other things for coordinating the work of the Committees and Work Groups which, using the resources of the offshore oil companies, develop industry-wide positions on matters of mutual interest. These are disseminated to Member Companies and, if appropriate, communicated to Government.

The whole offshore industry was shocked by the Piper Alpha tragedy and all of us will always remember precisely where we were when we first heard the news. The industry was shaken by the discovery that its carefully engineered safety systems could, with a particular chain of circumstances and events, be so defeated with such a human cost. We resolved immediately that it must never happen again and set about urgent re-appraisals of our management practices and hardware.

Part 2 of the Inquiry dealt specifically with measures to prevent a future major accident. Under the umbrella of UKOOA the offshore operating companies gave evidence to Lord Cullen and his Assessors on all the issues which he identified as relevant to Part 2 of the Inquiry.

Sixty-four expert witnesses gave evidence, of whom 34 represented UKOOA. Other sources of evidence included the Health & Safety Executive, the Department of Energy, the Trade Unions, the Department of Transport and the Norwegian Petroleum Directorate. This body of evidence, together with the record of the cross-examination of the witnesses, provided the basis for Lord Cullen's recommendations. It also provides the industry itself with 'state of the art' statements by experts on a wide spectrum of safety related issues.

The experience of Piper Alpha, plus the evidence accumulated at the Inquiry, has enabled the industry to initiate and implement many safety improvements during the past two years. Since Piper Alpha we have been spending over £1 million per day on safety provisions which are based entirely on the lessons we have all learned from the tragedy. By the end of this programme we expect to have spent over £850 million in this way.

UKOOA's safety initiatives include:

● Central Training Register

The Central Training Register set up at UKOOA's instigation by the Offshore Petroleum Industry Training Board (OPITB) will provide for the first time a record of safety and survival training carried out in accordance with UKOOA Guidelines. It will assist operating companies and contractors to ensure that no one is allowed offshore without a valid certificate of training.

● Permit to Work System

The Permit to Work (PTW) System is one of the foundations of safe working and accident prevention and is employed throughout the petroleum industry, both onshore and offshore. Individual operators design their own PTW systems based on Guidelines published by the Oil Industry Advisory Committee (OIAC) which comprises representatives from the oil industry, the Health & Safety Executive, the Department of Energy, and the Trades Unions.

The OIAC Guidelines are being revised following Piper Alpha to incorporate the lessons learned and UKOOA member companies have increased their efforts to audit their PTW procedures to check that they comply with the best industry practice and are being followed on all occasions.

● Emergency Shutdown Valves

Fire and explosion are major hazards offshore and if an accident does hap-

pen which results in a fire, the first priority is to contain its impact by shutting off the supply of fuel. Even before Piper Alpha, pipelines were fitted with emergency shutdown valves which isolated the pipeline contents in the event of fire, but the experience of Piper Alpha showed that the precise location of a valve can be critical. A properly located and protected emergency shutdown valve provides a secure first-line defence against the uncontrolled release of the pipeline contents. The advantage of an emergency shutdown valve located above the water is that it remains accessible for inspection, testing and maintenance.

In the last two years companies have checked the location of over 400 emergency shutdown valves and have repositioned over 150 of them. Where appropriate, additional protection from fire and falling debris is being provided.

This particular programme of safety improvement, which is scheduled for completion by the end of 1990, has cost the industry over £230 million in 1989/90.

● Subsea Isolation Systems

In special circumstances, for example where large diameter gas pipelines are present, the installation of subsea isolation systems can provide protection against the failure of the platform emergency shutdown valve or of the pipeline riser itself. This double protection would ensure that an accident on the platform, which is severe enough to damage the platform emergency shutdown valve or the pipeline riser, does not escalate.

Prior to Piper Alpha, 10 subsea isolation systems had been installed in the North Sea. Since Piper Alpha, operators have been carrying out safety assessments to determine priorities for the installation of further subsea isolation systems. As a result of these assessments a further 67 systems have been installed or committed at a cost of over £350 million.

● Smoke Hazard

Smoke proved to be a major hazard on Piper Alpha and operators have been and are looking closely at how smoke could hinder evacuation and how its effects could be mitigated. Smoke is inevitably formed during a hydrocarbon fire but its ingress into the accommodation module can be prevented and additional personnel protection provided. For example:

Where they are not already provided, companies are fitting smoke

Dr Harold Hughes

detectors in the air intake ducts of accommodation modules to ensure that the smoke dampers shut automatically as soon as smoke is detected.

Offshore installation fire fighting teams are trained in the use of breathing apparatus, but in addition, consideration is being given to the provision of easily portable smoke hoods to all offshore personnel. These could provide protection for a vital few minutes in smoky conditions. In December 1989, UKOOA and the Department of Energy commissioned a joint study at Aberdeen University to develop a standard for smokehoods suitable for use offshore. We expect this standard to be available early in 1991. A number of companies have provided currently available smokehoods as an interim measure; others are waiting until the offshore standard is available.

● Evacuation and Escape

If, as a last resort, a platform has to be evacuated reliable means to do so safely must be readily available.

Helicopters are the most convenient way of evacuating an installation but in addition every platform has its own dedicated evacuation system which is initially completely independent of external help. The platform lifeboats provide the primary means of evacuation. They are totally enclosed and self-propelled to assist them to clear the platform safely after launching.

Escape routes are provided from every part of the platform to the helideck and the lifeboats. The main requirement for escape routes is that there must be more than one way of escape available from any particular part of the platform. Companies are providing further improvements, for example the installation of heat shielding and improved lighting which is self contained and needs no external power supply. More use is being made of floor level photoluminescent strips which remain visible in poor light.

Piper Alpha has also made the industry more aware of the need for secondary evacuation systems to cope with the situation where some personnel may not be able to get to the helideck or lifeboats. The industry uses a range of devices, including knotted ropes, ladders, extending steps, nets and abseiling equipment. Every installation is different and new ideas must be tested to make sure that they do not create problems in use.

Information on new methods of escape is exchanged between member companies at the UKOOA Safety Committee meetings which are held monthly, and the joint UKOOA/ Department of Energy Emergency Evacuation Committee reviews new methods on behalf of the industry.

It is difficult to determine exactly how much these general safety enhancements cost, because they normally form an integral part of the detailed engineering of the platform equipment, but, using information obtained from member companies, it is estimated that in 1989/90 offshore operators will spend about £850 million on safety related hardware including emergency shutdown valves and subsea isolation systems.

● Formal Safety Assessment (FSA)

What I have said so far represents a conscientious and rapid response by a responsible industry to a major disaster. Our objective is to create and maintain a safe environment offshore, recognising the hazardous nature of our business. But there is a risk that this reaction to experience, however thoroughly carried out, will result in a piecemeal rather than comprehensive improvement in safety. If we are to convince ourselves in the industry, and those outside it, that the likelihood of another major disaster has really been reduced to an acceptable level then something more is required.

In its recommendations to Lord Cullen, UKOOA reaffirmed its previously held conviction that the prime responsibility for the safety of an offshore installation must remain with the operating company. UKOOA proposed that the present prescriptive regulations, promulgated under the Minerals Workings (Offshore Instal-

lations) Act 1971, should be gradually phased out and replaced with objective goal setting regulations, which would require operators to demonstrate the safety of each installation by carrying out a Formal Safety Assessment (FSA) similar to that required for onshore installations under the Control of Industrial Major Hazards Regulations (CIMAH). UKOOA believes, and has for some time, that the introduction and use of FSA represents the best way forward for the offsore industry to enhance safety and prevent disasters like Piper Alpha.

Mike Ferrow, who is the Chairman of UKOOA's FSA Work group, is typical of many other safety engineers throughout the offshore industry who are familiar with the safety case approach and who are eager to use it to the full in improving safety offshore. Mike Ferrow's Work Group has drafted UKOOA procedures to assist member companies in carrying out Formal Safety Assessments on existing and new installations.

FSA has many advantages compared with the current regulatory regime. It is flexible and can take account of different types of installation. There are over 150 existing offshore installations, fixed and floating, extending from the shallow waters of the southern North Sea to the deeper water found in the central and northern North Sea. Some produce gas, some oil and some oil and gas. Some are small, with only a handful of personnel or even not normally manned, others are large with hundreds of personnel on board. Prescriptive regulations cannot adequately cover this diversity of installations, except by a legal exemption process used at the discretion of the Secretary of State.

By its very nature, FSA encourages management thought, innovation and the introduction of improved safety techniques. Rigid regulation tends to lock safety into yesterday's technology. For example, free-fall lifeboats do not meet the requirements of current UK regulations.

FSA does not dictate to the operator how safety should be achieved, for example, by specifying the strength of fire walls or the amounts of fire water to be deployed. Therefore the most appropriate provisions for each individual installation can be used rather than the detailed and wholesale requirements prescribed in the current form of regulations.

FSA puts the spotlight on the operator. It focuses on his responsibility to create and maintain a safe place of work. Prescriptive regulations provide the wrong sort of prop for the operator — if he complies with the regulation he may feel that he is 'legally safe'.

Lord Cullen's Report was only published on 12 November 1990 and it will take some time for the industry fully to digest its contents. It is clear already, however, that Lord Cullen's painstaking and very thorough enquiries enabled him to grasp the fundamental safety issues relevant to creating a safe place of work in a hazardous and hostile offshore environment. He has produced a blueprint for the future which will make a major contribution to offshore safety and his findings will be carefully studied at every level within the industry.

Lord Cullen's main recommendations, which correspond closely with those put forward by UKOOA in evidence, set out that:

● **There should be a single regulatory body for offshore safety**
UKOOA believes that provided it is given the proper resources, the Health and Safety Executive can fulfil this requirement.

● **The principal regulations in regard to offshore safety should be goal-setting, requiring stated objectives to be met by the operator**
Goal-setting regulations create a flexible framework within which operators can use the best available methods and procedures to achieve the safety objectives required. They avoid the stagnation which inevitably attends the imposition of a rigid prescriptive regime.

● **The operator should be required to submit to the regulatory body a safety case in respect of each of its installations**
UKOOA is committed to the safety case approach. Most of the new installations designed in the 1980's have used safety case methods in one form or another. The UKOOA procedures, which have been issued to every company, will assist in harmonising the scope of the safety cases prepared for all installations including existing ones. The preparation of safety cases for all prior existing installations is an enormous challenge and will take time to implement.

When the CIMAH Regulations were introduced onshore in 1984, the Health & Safety Executive allowed 5 years for their implementation. UKOOA believes that, taking into account the work done already, the task offshore could be completed in 2 to 3 years. One advantage of the safety case is that it enables hazards to be identified early and therefore priorities can be established for remedial actions. This means that any safety improvements can be implemented while the safety case is being completed.

An essential ingredient of a safety case is the company's SMS (safety management system). UKOOA endorses Lord Cullen's conclusion that in the formulation of their SMS, operators should draw on the principles of quality assurance similar to those contained in BS 5750 and ISO 9000. To promote and facilitate active discussion between operators as to how this can be achieved, UKOOA organised a one day seminar in Aberdeen on 28 November.

To implement successfully these fundamental changes in the way offshore safety is to be administered and managed will require a dedicated and concerted effort by the Government, the Health and Safety Executive and the offshore industry all working together. UKOOA is keen and ready to play a full part in this challenging future.

Although we are still considering Lord Cullen's detailed recommendations, I can give you a preliminary assessment of our reaction to some of them.

● **Safety committees and safety representatives — the human element**

The present arrangement offshore provides every employee with the right to freely elect (and to be elected as) safety representatives. This is different from the situation onshore where safety representatives are appointed by a recognised trades union. We are pleased that Lord Cullen recognises the merit and democratic basis of the present offshore regulation.

In its evidence to Lord Cullen, UKOOA gave its full support to the extension offshore of the Employment Protection Act to protect safety representatives from victimisation. UKOOA also accepts Lord Cullen's recommendation that the training of safety representatives should be determined and paid for by the operator. I sincerely hope that these changes will further enhance the effectiveness of offshore safety committees which, however, seem to be working very well at present.

On the matter of safety, senior management must set standards. It is the job of middle management to convey it down line, with a relentless approach to safety.

● Permits to Work

UKOOA supports Lord Cullen's recommendations with regard to potential improvements to the permit to work system. Through our active participation in the Oil Industry Advisory Committee, we will make sure that they are incorporated into the guidelines which are currently being revised.

● Risers and Pipelines

I have already summarised the work going on to relocate pipeline emergency shutdown valves near the waterline on installations and in addition the installation of subsea isolation systems where a safety assessment demonstrates a safety benefit. These efforts are fully in accord with Lord Cullen's recommendations.

● Fire and Explosion

Lord Cullen's main recommendation that the regulations should promote an approach to the fire and explosion protection which integrates active and passive methods is fully endorsed by UKOOA. There is no doubt that the present regulations which divide fire fighting between the Departments of Energy and Transport has inhibited the development of improved methods.

● Accommodation, Temporary Safe Refuge, Escape Routes and Embarkation Points

The concept of a temporary safe refuge is in accord with UKOOA's evidence and Lord Cullen has made a number of specific proposals which will require detailed consideration by the industry. Much has been done already, but it will be a tremendous challenge to sensibly implement these recommendations especially on existing installations.

● Evacuation and Escape

UKOOA fully supports Lord Cullen's recommendation that operators should submit an evacuation, escape and rescue analysis in respect of each of its installations. He has set out a sound basis for this analysis and also made a number of specific and prescriptive recommendations with regard to the provision of lifeboats, life rafts and other escape and personal survival equipment and procedures. UKOOA accepts his judgement that a minimum level of prescription is desirable and necessary.

● Standby Vessels

UKOOA has for many years argued for the revocation of the regulation governing standby vessels. In recognising the merit of UKOOA's case, Lord Cullen has opened the way for a new look at the role and quality of these vessels which play such a vital and important part in offshore rescue and evacuation. I believe that the 'safety case' approach to the total escape and evacuation requirements will lead to a steady improvement in the capability of vessels used in an enhanced safety role.

● Training

UKOOA has always recognised the importance of proper offshore emergency safety training and is pleased that Lord Cullen has recommended that personnel who have not met the minimum requirements laid down in the UKOOA published Guidelines should not be permitted to work offshore. The Central Register, which has been set up by the Offshore Petroleum Industry Training Board at the instigation of UKOOA, will be fully in force by mid-1991, and will help the industry to implement this recommendation.

Conclusion

The industry now sees the main requirement as being the prompt and effective handover of responsibilities to the HSE, and immediate steps to ensure that the resourcing of that body, in its new role in offshore safety, be quickly and firmly established. There appears already to be some question of the resources available to the HSE against its present responsibilities.

In its evidence to Lord Cullen, UKOOA emphasised the need for proper resourcing of the new single authority that it recommended, and these comments are of course quite consistent with our evidence to the Inquiry. It is perhaps worth underlining that resourcing is not only a question of provision of money, important though that is. It also means the establishment of an organisation and the right positions and staffing structure within that organisation to ensure that staff with offshore experience and of capability can be recruited and retained.

I must emphasise again that it is UKOOA's wish, and all of its Member Companies, that this transition is effected with expedition and that the organisational issues which will undoubtedly emerge are tackled by the Government with determination.

In conclusion, I can say without reservation that UKOOA accepts and endorses Lord Cullen's recommendations. I am sure that I speak for the whole industry when I offer my sincere thanks to him and his assessors for producing a readable, lucid and well argued Report and set of Recommendations. It is no exaggeration to say that his report will become the blueprint for the future enhancement of offshore safety, not only in the UK where it has a special relevance because of its origins in the Piper Alpha disaster, but elsewhere. We believe its influence will extend all over the world. ■

Offshore safety — formal safety assessments

By Michael Ferrow, Manager, Safety, Environment and Quality Assurance, Conoco (UK) Ltd

This paper summarises my own views of Lord Cullen's recommendation on Formal Safety Assessment (FSA) after one week's study of his lengthy report. Before going into detail, the philosophy and the beliefs which underlie the thinking about FSA are covered.

- No two accidents have ever been quite the same.
- Almost all accidents seem to have common general or underlying causes related to 'safety management' at some point in time.
- Consequences of accidents are usually predictable in terms of type and magnitude of damage and are specific to each unique set of circumstances.
- Specific, prescriptive regulation cannot address these fundamental points. Goal setting regulation can.
- 'Formal Safety Assessment' is founded on this train of thought.

Formal Safety Assessment

Four main points are covered:

- What Lord Cullen has said
- What UKOOA has been doing
- What Conoco have been doing
- What we all do next.

Going through these points should lead to a somewhat better understanding as the issue is one of culture change rather than a new set of rules to learn.

There is of course 'language' which is used and it is important for everyone to be very familiar with the terminology. Understanding the language is simply a key to clearer understanding.

What Lord Cullen said

Lord Cullen's recommendations on FSA are covered by recommendations 1 to 22, if the issue of removal of current prescriptive regulation is included.

There is no substitute for reading the recommendations and the supporting text and this review is no alternative for that.

The principal issue is that operators must submit a 'Safety Case' which demonstrates several things.

- The Safety Management System (SMS) for the company is adequate
- The SMS for each installation is adequate
- Major hazards are identified and controlled
- The Temporary Safe Refuge (TSR) is adequate
- Escape evacuation and rescue are adequate.

These are the basic objectives which are further expanded. They provide a good way of thinking about what a complete Formal Safety Assessment would cover. The Safety Case is something tangible which results from the FSA and refers to those five areas in sufficient detail to demonstrate their adequacy.

Safety Management System

Turning to the SMS, the recommendations go beyond the Control of Industrial Major Accident Hazard Regulations (CIMAH) by requiring an SMS covering all stages of a project and the way the company is managed.

The SMS should set out safety objectives, the system by which those objectives are to be achieved, the performance standards which are to be met and the means by which adherence to the standards is to be monitored.

Such a system parallels efforts being made by operators to work within Quality Assurance principles. The advantage of using SMS rather than the quality assurance is that there can be no confusion with quality control or inspection in anyone's mind.

Procedure

The objectives of the Safety Case were discussed earlier. The more detailed content of the submission includes:

- A demonstration that hazards are minimised — as low as is reasonably practicable (ALARP)
- Demonstration that exposure to consequences is minimised (ALARP)
- Demonstrate (by QRA) acceptance standards for integrity of TSR,

escape routes, embarkation points and lifeboats.

- Fit emergency controls and means of communication in TSR
- Carry out a fire risk analysis
- Carry out an Escape Evacuation and Rescue Analysis (forthwith).

Further detail is given on how a logical argument must be built up which addresses how the platform is to be safe and under what conditions it is safe.

Design accidental events

Lord Cullen has clearly accepted the principle of design accidental events and has defined it as an event which will not cause loss of the following:

- The integrity of the TSR
- The possibility of at least one escape route from each location on the platform
- The integrity of a minimum complement of embarkation points and lifeboats specified for personnel in the TSR
- The possibility of at least one escape route to each of these embarkation points.

Acceptance standards for risk and endurance time should be set before submission of the Safety Case using ALARP principles. (Initially the acceptance standards for TSR are to be set by the Health and Safety Executive).

Safety Case

The Safety Case is to be submitted for all installations, fixed and mobile, existing and new. The date is to be set by regulation with the word *urgent* used by Lord Cullen to ensure that an ambitious programme is undertaken.

The Health & Safety Executive should have the power to shut down installations where there has been no acceptable safety case submitted by the date, yet to be established. Updating is required for major changes or on a three to five year cycle.

There is scope to go outside existing prescriptive regulation before such time it is repealed although an exemption would be required.

The situation on Annexe B submissions for new projects is a matter for further discussions between operators and the regulatory body.

Conoco approach

Since 1984 Conoco have effectively applied an approach analogous to the onshore CIMAH regulations to new projects. The V Fields project which

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was used as an example in Lord Cullen's report had an 'Engineering Safety Plan' which was available for review by regulatory bodies, should they have required it.

The Engineering Safety Plan (ESP) described all potential hazards, their consequences and the appropriate control measures. Detail Hazop Study records were also kept in the ESP. The Project Quality Plan described an SMS for the Design and Construction phase. The V Fields work can be quickly and easily upgraded to a Cullen-style Safety Case.

Conoco have more recently reorganised themselves in a way which suited their own 'safety culture' and also would meet the new regime. A Safety and Environmental Quality Assurance (SEQA) group was formed in 1989 which covers safety, safety engineering, environmental issues and quality assurance. This approach has been successful in getting these issues central to management thinking. Also, the offshore 'safety advisers', who are the cornerstone of the group are working closely with safety engineers, environmental scientists and quality assurance engineers, further professionalising their role and ensuring audits cover broader issues than ever before.

On the specific point of Formal Safety Assessment, Conoco have appointed, within the SEQA group, an FSA project co-ordinator who has started pulling together the pieces we already have in place and is scheduling the production of safety cases. Conoco are organised in a matrix and the FSA co-ordinator will use resources from SEQA, production operations, engineering and other groups as required. In this way each group is intimately involved in its own solution for safety issues, a point Lord Cullen has emphasised. The FSA co-ordinator is, in a sense, part of the SMS in that he is in a strong position to identify weak or slowly developing areas of any of our safety cases.

Conoco have five existing fields needing retrospective safety cases. V Fields was discussed earlier and is largely complete. The four remaining, two gas and two oil, have many of their elements complete but now need to be checked against Lord Cullen's recommendations.

Overall, Conoco expect to complete our Safety Case submissions within 18 to 24 months, although this will largely depend on detailed format requirements and resolution of acceptance criteria with the HSE.

Action by UKOOA

UKOOA formed a workgroup on FSA shortly after the Piper Alpha disaster. There has been a great deal of interest and support with around 15 members represented at a full workgroup meeting.

Objectives were threefold:

- A wider focus away from specific safety issues — UKOOA was very conscious of the fact that after Piper Alpha the operators could easily concentrate too quickly on specific issues to the detriment of the broader picture.
- To produce a Working Guidance Document — this is now available to member companies. The model index addresses all the points which Lord Cullen recommends including safety management both at company and installation level.
- To achieve an effective programme for industry — UKOOA members are already working to a common framework. There is a good opportunity now to increase dialogue with government and with mobile rig operators.

Two other useful events are worth mentioning. Firstly, the workgroup organised a seminar for member companies in June 1990. This was attended by general managers, project managers, engineers and operating personnel as well as specialists. There was a useful increase in awareness of FSA and its implications as a result.

Secondly, the workgroup managed to maintain a limited but useful involvement with the Department of Energy to ensure that we were on similar lines of thinking.

Future action

Now that the HSE is to be the regulatory authority, everyone will welcome a swift transition and a very early start.

There are many outstanding issues to be discussed between the industry and HSE and treated as a matter of utmost priority. The new division could usefully be staffed by a cross-section of inspectors from the Department of Energy and HSE in a way that makes use of the very scarce resources. In one sense this should make no difference to the operator. My own vision of the goal-setting regime is however one where skilled and experienced operators demonstrate a safe operation to a skilled and experienced regulator. In this case the dialogue is at a level where a process of 'continued improvement' becomes a reality.

UKOOA is willing and able to work with HSE developing new guidance and new regulations and already has a proposed framework for a safety case, discussed earlier. UKOOA also plans to continue the seminar programme for members, for example, a seminar concerning quality systems.

Operators should be getting started irrespective of anything else, in preparing safety cases. There is a resource problem because everyone is trying to do the same things at the same time in the same places — Aberdeen and London. However, this is a surmountable problem; there are many good resources in every operating company, particularly engineers and experienced operating staff. The Conoco SEQA group has around 25 percent of its staff currently carrying out specialised safety work who have moved from other disciplines. The quality of their work is excellent; this approach will continue.

Everyone in the oil industry should read Lord Cullen's report or, at least, the essence of Volume II. It is incumbent on the whole work-force to understand the basic principles of FSA and what the Safety Case is for. Individuals may have ideas and things to contribute to the overall debate.

If we all seek continual improvement by working together, then there is real scope for all these parties to succeed in their objective — a safe and profitable industry which benefits government, the operator and each individual employee to the maximum possible extent. ■

References

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This article and that of Dr Hughes (page 5) will form part of the proceedings of the conference 'Offshore Safety — the Way Ahead' to be published shortly. It will be available from the IP Library.

Conference Report

Diving support vessels — rates too low

An oversupply of diving support vessels (DSV) — causing a reduction in charter day rates — was the main point of concern at a recent conference held at the Institute of Petroleum.

For operators and contractors in the DSV sector have effectively seen the average rate they can charge drop by 60 percent in real terms since 1985 due to a surplus of assets.

Correspondingly their utilisation rates have fallen to around 40 to 50 percent, almost half that of rigs and supply boats, creating a situation for the industry where it is incapable of acquiring rates to cover rapidly increasing costs.

However, despite the doom and gloom, the conference, sponsored by Derrick Offshore, also held out some hope for the future, as DSV utilisation is expected to increase as a result of the Cullen Report recommendations and more subsea work.

But speakers at the conference warned that demand was not everything and urged the industry to help itself by developing strategies to reduce the surplus — hence improve the day rates — and to look at how DSVs were used to improve utilisation.

Mr David James, newly appointed chairman of Davies & Newman, said the DSV sector may have difficulty surviving into the 1990s unless it got its act together. Because of the large number of DSVs in the market he could not see any profits ahead for the industry.

Mr James suggested drastic measures to solve the problems facing the industry. Firstly, he called for an embargo on rate cutting by vessel operators trying to gain work at any price. Secondly, he called for financially rather than operationally-led decisions within the sector to gain the confidence of city investors.

Mr Richard Shepherd, Managing Director of Petrodata, noted the decline of long-term charters for field vessels stemming from the growing confidence of oil companies to rely on vessels being available on the spot market.

However, Mr Shepherd was confident for the future because of the expected growth in projects due to start in the next few years. He expected a high utilisation factor up to 1993. At present, however, the market was very sluggish compared to the 90 percent utilisation rate enjoyed by rigs and the 80 percent rate recorded for supply vessels.

He added that the way for the business to make money was to include the DSV as part of a package for a large contracting concern.

Mr Tom Ehret, Managing Director of Stena Offshore, agreed with Mr Shepherd, and went on to propose a number of measures, needed in the short-term to secure long-term profitability. He called for a halt on new building, the withdrawal of surplus class 2 vessels and the support of oil companies in discouraging newcomers entering the market.

Mr Ehret also called for a £30,000 day rate, pointing out that the average day rate for a class 1 DSV had dropped from £25,000 in 1985 to £18,000 in 1990. A reduction of 60 percent in real terms considering that inflation had increased by 30 to 35 percent over that period.

Mr Alex Kraft, Director of independent vessel owner Anders Wilhelmsen, disagreed with Mr Ehret and Mr Shepherd about the need to package DSVs in a large integrated company, saying that despite more than 90 percent of the DSVs in the North Sea being owned by four companies, there was still a role of the independent DSV operator. ■

IP Luncheon

It is not easy being 'green'

By Robert Horton, Chairman, BP Plc

Politicians are well accustomed to the difficulties of seeking to please 'all of the people, all of the time'. We in industry have a slightly smaller constituency to satisfy — only slightly. But when it comes to the environment, we too are in the front line of having to please 'all of the people all of the time'.

It's not easy; but I personally am convinced that we in industry have got to try to find ways of doing just that. Our customers, our employees, our shareholders, our legislators and the communities in which we operate all demand from us increasingly high standards in health, safety and the environment. And that isn't just a hunch, or something I've picked up from the media.

In BP, we have conducted our own research into how our audiences view the environment and what they expect from us.

They want the right action to be taken.

But action alone is not enough. Our research shows that industry must demonstrate its genuine commitment and enthusiasm for the cause if its environmental performance is to be trusted.

There is an air of cynicism abroad which says that industry is only prepared to do the irreducible minimum.

I don't believe that.

Challenge

But if industry is to win support for the action which it is undoubtedly taking, it has got to show that it is doing it with the same fervour and energy that underlines all its other commercial decisions.

That is a challenge which I accept: and indeed, BP's new policy on the environment is all to do with this challenge. However, good intentions and evangelical brouhahas are not enough.

What must also be faced up to is that there is room for genuine uncertainty as to how best to proceed; that there is honest disagreement on certain specifics which must be resolved if sensible solutions are to be found.

When, for example, Nigel Hawkes, *The Times* Science Editor, felt moved to accuse Mrs Margaret Thatcher recently of 'abandoning her scientific scepticism' on global warming and of adopting 'the simple clichés of the environmental activists,' he reminded us that some scientists too are suspicious of 'enthusiasts'.

Environmental issues cover an enormous compass. Scientists, economists, businessmen and politicians all have individual, but entirely legitimate, views to feed into the debate. In certain areas, to do the wrong thing can be as dangerous as doing nothing at all.

That is why the word 'green' is so misleading. It looks good in headlines. But a term which fails to distinguish between climatic change on the one hand and cleaning up litter on the other is less than helpful when debating what needs to be done.

Unfortunately, we're not searching for a solitary and correct decision. We are faced with a whole range of questions for which there is a variety of entirely plausible responses; and the examiners are not even agreed amongst themselves as to what constitutes a 'pass' or a 'fail'.

So although the word 'green' may imply a direction, it does not tell us very much about how to get there, or indeed what is the destination.

Who pays?

Yet, at the end of the day there is one simple truth which, understandably, not everyone is inclined to accept.

If we really want a cleaner environment, in the words of Chris Patten himself 'we have all got to pay for it — whether as customers or taxpayers'.

Whether it was a Freudian slip to leave out 'shareholders', I don't know. But they certainly ought to be included.

One problem, however, is how to arrive at the costs and how to decide who should pay the lion's share. Experts can debate for hours how best they should be calculated and allocated.

The classic economic approach is to conduct a cost benefit analysis and then devise economic incentives — which normally means taxes but can involve subsidies as well — to influence consumer behaviour.

But the environment is a field where it is singularly difficult to measure all the costs and benefits. In the end, it often comes down to politics as to who should foot the bill. Needless to say, this often smacks of centralism and dubious political motives. The idea that politicians are less likely than industry to take a selfish view of the environment is totally absurd.

From industry's point of view, however, the question is sometimes academic. Because for us, the practitioners, the question 'who pays first' is almost as important as who pays in the end.

The reality for industry is that it is we who always shoulder the majority of the up-front costs; and in any case, it is often not 'practical politics' to recover them all from the market place. This will become increasingly true in the future.

That is why I remain sceptical of the ingenious cost-benefit approach advanced by some economists.

I agree entirely that 'preserving and improving the environment is never a free option: it costs money and uses up real resources', to quote the distinguished economist, David Pearce.

I also agree that it would, in theory, be highly desirable to devise some objective and scientific way of measuring how much people are willing to pay to preserve or improve the environment — both for themselves and future generations.

But I have to say that empirical studies such as those to measure 'the option price and existence value of grizzly bears and bighorn sheep in Wyoming' do not really help when it comes to assessing the environmental consequences of, for example, developing oil in Alaska's Arctic National Wildlife Refuge. In such a case, industry is fighting for a hearing along with many others. In the end, someone in politics will have to decide.

It is a question of judgement which, in my view, is hardly made any easier by asking consumers theoretical questions which they are hardly in a position to answer.

There is no point in going to the trouble of ascertaining people's theoretical choices if there is no practical means of making such choices a reality. And there is certainly no point in hitting the consumer via taxes unless a viable alternative exists.

Carbon taxes

Let me move on to a specific environmental problem to demonstrate what I mean.

Robert Horton (left), Geoffrey Chipperfield CB, Permanent Under Secretary of State, Department of Energy, Sir Archibald Forster, Chairman and Chief Executive, Esso UK plc and immediate past president of the IP and Basil Butler, Managing Director of The British Petroleum Company plc and IP President.

We all know about the 'greenhouse' problem — and we have all heard of carbon taxes which allegedly solve the problem by penalising carbon dioxide emissions.

Let me remind you, however, that the existence and degrees (literally) of future global warming are the subject of heated — another appropriate metaphor — debate.

The climatic consequences of warming are even more uncertain, and the economic consequences as speculative as anything that happens on the New York Mercantile Exchange.

Nevertheless, despite these uncertainties, it is obvious that — at least in Europe — a political momentum is building up in favour of carbon taxes as a means of cutting carbon dioxide emissions.

Now in a number of ways, this need not worry us in the industry. Taxes have one great merit in that they do not prescribe the technical solution in advance; that would be foolish, because today's technology might not be the best available.

Secondly, they would act in the interests of oil and gas *vis-à-vis* coal.

Thirdly, their effect on the demand for transport fuels would be long term and slow, giving us plenty of time to adapt the pace of expansion of capacity.

But carbon taxes would, especially in the transport fuel business, be pretty obvious, specific fuel taxes designed to hit the consumer.

And my worry about the taxation approach is precisely that it would hit our customers first, and probably hit them too hard.

I said that there is not much point in asking consumers theoretical questions about what they are prepared to pay if they are denied the means of making a choice. Certainly, consumers will not like being hit by carbon taxes unless viable alternatives exist to carbon based fuels.

Consumer choice

I can illustrate the problem of consumer choice from our practical experience of unleaded petrol in this country.

Consumers did not make a big switch to unleaded until it was made cheaper than the alternative — so much, incidentally, for the argument that consumers are always willing to spend more for a cleaner environment.

But of greater importance, the tax penalty for leaded only made sense — and only could make sense — once most consumers had cars which could actually use unleaded fuel — or at least could be easily and cheaply converted.

If this option had not been open, the tax penalty required to achieve the same level of reduction in emissions would have been enormous and imposed great sacrifices on the consumers concerned.

Incidentally, it would also have given politicians huge — I almost said 'windfall' — revenues, disrupting whatever fiscal structure we had.

It would also have disrupted the balance of demand between different types of cars, leaving some manufacturers with losses and idle capacity — and others with exactly the opposite. In economists' language, it is the econ-

Charles Smith, Managing Director Chevron (UK) Ltd and IP Vice President (left), Dr Frank Feates, Director and Chief Inspector, Her Majesty's Inspectorate of Pollution, Department of Energy and Robert Horton.

omy that would have had to bear adjustment costs.

My point is that it is shortsighted in the extreme to suppose that all environmental choices are made at the point of sale.

They are not.

What the car manufacturers decide today limits the choice that consumers have three, five or even 10 years down the road, taking account of lead times in the car industry and in the life of a car.

So, the whole issue of carbon taxes needs very careful debate.

We should bring into the debate another possible approach, namely the role of goal setting to encourage improvements — with incentives which might take the form of tax breaks.

Role for BP

Taxes alone cannot bring about an increase in energy efficiency and a reduction in carbon dioxide. Taxes alone cannot help the environment.

Of course there is a vital role for industry in seeking to improve the environment. There is much that we can and should do irrespective of government.

As a step in this direction, BP and a number of other companies in Europe are working with the International Chamber of Commerce to identify areas where greater energy efficiency can be promoted in order to reduce carbon dioxide levels.

We in BP will continue to give a high priority to energy efficiency across the whole range of our operations. Recently, I launched BP's new policy on health, safety and the environment. This policy took into account the research of public attitudes to which I have already referred. It also took account of the fact that that these three areas — health, safety and the environment — were themselves fields of competition and business opportunity.

Some of the recommendations from the public to demonstrate our commitment were very interesting.

One suggestion, for example, was that BP should develop an attractive, organic carrot.

Another that I should take a six months sabbatical cleaning out oil tanks. That last idea has certain practical disadvantages; but actually, I do take it seriously. Although there are great dangers in gesture politics, I do believe that industry must do something to halt the mistrust that surrounds any firm's environmental objectives.

We need to show that we are not just involved in improving processes or in better housekeeping.

How, for example, can industry show that it is open to new, environmental ideas in the future? Should it move faster towards encouraging its employees to work at home? Should it move faster to the paperfree office? That's what we're trying to do in BP's Corporate Centre. Should managers be judged as much on their environmental performance as upon their ability to win new orders?

What I am certain is that industry needs to show that it means business. I would add that we in BP are determined to show that the environment can be very good business.

In all this, I am not saying that all that we need is a Public Relations exercise.

Industry has a selfish reason for wanting to improve its environmental performance — or to put it less crudely, enlightened self-interest governs all of our decisions in this area.

In any case, I often wish that our critics would remember that shareholders and people who work in industry have their children and grandchildren to worry about in exactly the same way as do other members of society.

I certainly am not prepared to have on my conscience the thought that I contributed to a future ecological disaster. But I'm equally going to make no apologies for adopting a rational approach to the whole problem.

To those who argue that it pays a company to run unnecessary risks in the environment, I would only say that they have a very curious view of what constitutes commercial success. The political, financial and social implications of negligence in this area can put a company at risk. That is the bottom line.

I happen to be convinced, however, that there are also competitive advantages in developing better environmental practices than those of competitors, and of simply being more effective in achieving the desired results.

BP's aim is not necessarily to spend more money on the environment than our competitors — although in some cases, we may well do so — but to spend it more wisely and in a more rational manner.

A company will benefit when its costs of complicance with legislation are lower than the firms operating at the margin.

However great the potential of market forces in this area to promote good environmental performance, I equally have no doubt that the role of legislation is inescapable. Hence the need to implement regulations effectively and economically.

Here again, however, I am only seeking to emphasise how wrong it is to suppose that a company's environmental expenditure is 'reluctant' expenditure.

Every company must consider what it can afford. But if the environmental implications of any operation are so serious as to threaten the economics of a project, then it is the project itself that

is put at risk. It ought never to be the environment.

So far as the oil industry is concerned, I think it is better to deal with specifics in order to illustrate the magnitudes we are sometimes talking about.

BP and the environment

In BP's case, for example, the cost of upgrading our effluent treatment facilities at our Grangemouth refinery is £20 million. This has not been undertaken to comply with the law. It represents a commercial decision to install the best available technology at our UK refinery.

Similarly, we spend each year some $55 million on environmentally related R&D at our research centres in Sunbury and Warrensville — which incidentally has been rechristened 'The Warrensville Research and Environmental Science Centre.'

'minimum waste'; programmes to maximise our control of loss; the moulding of an environmental consciousness in the office — these undramatic and 'unsexy' activities are the key to success.

For success in this area, you look to the individual. Much of BP's new approach towards health, safety and the environment is directed at encouraging individual members of staff to take the matter seriously and personally.

I don't think that environmental problems can be overcome by money alone. I believe that very often a company's environmental performance can be improved without spending any additional money at all.

It is a question of commitment and ingenuity; of finding better ways of doing things both to the community's advantage and to your shareholders' as well.

That is why, in future, each BP business will have its own full-time energy manager to ensure that these areas receive undivided attention.

That is why every individual in BP will undertake specific training on this new policy.

BP's new environmental commitment also requires us to be more open to the outside world — taking our customers and society generally into our confidence; letting them see for themselves how we are tackling the problems; letting them satisfy themselves that our actions match our rhetoric. All this I am convinced will bring commercial rewards and credibility.

'Taxes alone cannot help the environment'.

Once again, this is not expenditure necessitated by regulation. It is money spent to ensure that BP is amongst the leaders of the pack — a commercial decision to safeguard and enhance BP's competitive position in the market.

This raises a further consideration which is all too easily forgotten.

Understandably, when discussing the environment in the public arena, there is always a tendency to concentrate upon the mega projects which catch the headlines. BP has its fair share of flagship projects — Wytch Farm being the obvious example.

Equally, it is the big disasters — such as *Exxon Valdez* or Piper Alpha — which people find easy to remember.

But if you are serious about achieving an all-round increase in environmental performance, it is the mundane, everyday activities which are equally as important and which require constant attention as a matter of daily routine.

These may not, as I intimated earlier, catch the public's imagination. That is something we need to do as well for our actions to carry conviction. But we also have to satisfy the experts. And experts agree that a cavalier approach on everyday matters is a sure sign that something, eventually, will go wrong.

Policies directed at achieving

No easy solution

When an industrialist asserts that it's not easy to be 'green', he invites the response, 'Well, he would say that, wouldn't he?'

That's partly why I so dislike the simplistic term 'green'; I've tried to explain how, in so many areas of the environment, industry has as good a reason as any to enhance its performance and strive for higher standards. Continuous improvement is not just a pious hope. It is a practical objective.

There are other aspects of the question which are not addressed so simply. But in so far as the problems are not 'easy', let nobody be in any doubt that industry has a vital role in contributing to a solution.

Let me give an example of how public policy, if not properly thought through in consultation with industry, can go badly awry.

I am thinking here of current proposals by the European Commission to extend EC public procurement rules to intra-Group services. In the extreme, these could be read to require that companies like my own should put out to competitive tender their own internal services such as legal counsel, engineering and R&D.

Can you imagine BP accepting bids from our oil company competitors when we want legal advice, for example, on how to break into a new market?

In this field, as in environmental policy, it may sound trite and hackneyed, but it is also true that industry needs to be seen as part of the solution to the problem, rather than part of the problem itself.

If anybody doubts that, let Charles Dickens remind you of what the environment was like in London a century ago.

I don't know how much Dickens is read nowadays. I rather fear that he may not be seen as very helpful when it comes to cultivating 'communication skills'. His sentences and paragraphs are far too long for the modern obsession with 'sound-bites'.

But there is no better time to read Dickens than at Christmas. His descriptive writing of London fog, mud, dirt and noise make me very grateful to be alive today — at least so far as health, safety and the environment are concerned.

Moreover, I would assert — even though he might turn in his grave at the thought — that it is industrial technology, ingenuity and know-how that has transformed the quality of life for the majority of our citizens.

That still remains the challenge. Priorities change and expectations vary. Some countries are eagerly awaiting their first industrial revolution as we learn to cope with some of the adverse consequences of our own.

There are always difficult choices to be confronted; there are always sensitive balances to be struck. But I see no reason why governments, consumers, scientists and industrialists should be divided in their objectives.

Rather than think the worst of each other, let us have faith in each other's good intentions. In this way, I am sure we will continue to demonstrate that material improvement and an enhanced quality of life are both sides of the self-same coin. ■

Crisis in the Gulf: losses and benefits for the Soviet economy

By Dr Andrei A Konoplyanik, USSR State Planning Committee (GOSPLAN)

The dramatic growth in world oil prices following Iraq's invasion of Kuwait has led to some estimates that the Soviet Union will benefit greatly as a result of the conflict in the Gulf. The background for such estimates probably rests upon the Soviet foreign trade structure. The major portion of Soviet exports consists of crude oil and petroleum products and some other goods — mainly raw materials such as gas and gold, whose prices respond sensitively to the fluctuations of petroleum market prices.

Thus, Professor Goldman for the Center of Russian Studies attached to Harvard University and others have stated that if world oil prices increased by only 20 percent, the USSR hard currency annual revenues would rise by some $5 to $6 billion. *The Wall Street Journal* estimated that the Soviet Union will gain annually $7.5–$10 billion of foreign currency owing to the price factor alone. Accordingly to PlanEcon director Jan Vanous, cited in the Soviet press, every $1 per barrel increase of petroleum prices will bring to the Soviet Union $1 billion in additional revenues. And so on . . .

Let us take into account that up to the beginning of November oil prices increased by some $13/bbl or by some 70 percent from the eve of the invasion. That means that Soviet hard currency receipts should increase by some $17.5–21 billion annually, according to Professor Goldman, or to some $13 billion, according to Mr Vanous (not taking into account oil demand price elasticity).

The few Soviet authors who have written about the economic aspects of the Iraqi-Kuwaiti conflict have not been critical when quoting these estimates. That is why readers have been convinced of the enormous benefits to this country arising from the Gulf crisis.

No enormous benefits

Let me try to shatter these illusions.

It is raw materials, mainly energy resources and above all crude oil and petroleum products, that constitute the bulk of Soviet exports (crude oil amounted to 19·1 percent and petroleum products 8·2 percent of the total in 1989). In 1989 crude oil exports amounted to 127.3 million tonnes valued at 13.1 billion roubles and exports of petroleum products amounted to 57.4 million tonnes valued at 5.6 billion roubles. The Soviet Union has been receiving almost half of its hard current earnings from liquid fuel exports and, according to American sources, four-fifths of total hard currency earnings have been received from the export of only four items — liquid fuels, gas, gold and arms.

It is evident that the Soviet Union can obtain some additional benefits as a result of the Gulf crisis only in the markets of the first three export goods mentioned.

Up to the end of last year the increase of world oil prices will influence the USSR export revenues only through the trade with industrially developed and developing countries. This oil price increase will not influence the trade with COMECON countries in 1990 because of the so-called 'Moscow formula' still applied in the accounting practice of the intra-COMECON trade. According to this formula, the annual level of Soviet oil export prices has been calculated as an average of world market prices item for the previous five years. That means that the oil price jump initiated by Iraqi-Kuwaiti conflict will be considered by the 'Moscow formula' only while determining the level of 1991 prices and only partially (by some one-tenth of the scale of price increase).

Hence, in 1990 this price jump will not affect 65 percent of Soviet crude exports (82.6 million tonnes in 1989) and 22 percent of product exports (12.6 million tonnes in 1919). But all the scale of this world market price increase will be considered in the Soviet oil export price from the beginning of 1991 because the action of the 'Moscow formula' will be eliminated from 1 January, in view of the transition of intra-COMECON foreign trade accounting to a dollar-clearing system based on world prices.

Let us take the eve of the Iraqi invasion of Kuwait as the starting point. On 1 August the price of Dubai crude which is similar to the Soviet export grades was $17.9/bbl; on 30 October it was $30.8/bbl. On 28 September and 11 October Dubai price hit the peak values of $35.5 and $35.3 respectively. The average August price was $24.2/bbl, $29.4/bbl in September and $30.9/bbl in October.

If the price remains assumptionally the same until the year-end, the average Dubai price for the period August-December would be $29.3/bbl. It follows from the above that if Soviet oil exports to the West remain at the 1989 level of 44.6 million tonnes, the USSR could draw an additional $1.5 billion in crude oil revenues over these five months.

Fuel oil and gas/diesel oil account for some 80 percent of Soviet petroleum product exports (23.2 and 22.3 million tonnes respectively last year). Gasoline accounts a bit more than 10 percent (6.7 million tonnes). The half of the rest is accounted for by kerosene and jet fuel (2.1 million tonnes) and bunker fuel oil (1.6 million tonnes).

If we go by the same assumptions as for crude oil, it will follow that in August-December period last year the USSR could have earned an additional

Source of information	*Estimate of the USSR prospective benefit*	*Comment*
Prof Goldman (*The New York Times*), *Boston Globe*, etc	$5–6bln annually in hard currency in the case of world oil price increase by 20%	For the period August-October the prices increased by 70%. That means that USSR annual benefits should amount $17.5–21bln
The Wall Street Journal	$7.5–10bln annually due to the price factor only	
Jan Vanous (PlanEcon)	Every $1 oil price increase brings to the USSR $1bln of additional revenues	For the period August-October the prices increased by $13/bbl. That means that USSR annual benefits should amount $13bln

Figure 1: Some Western estimates of the USSR prospective benefits as a result of the conflict in the Gulf

$1.5 billion through petroleum product exports. In other words, the total increase in crude oil and petroleum product export earnings last year would be within $3 billion. But will this amount of additional revenues be received in practice?

I will give the negative answer to that question. And not for the reason that only some 60 percent (27–28 million tonnes) of the Soviet liquid fuel export to non-communist countries in 1989 was sold for hard currency and the rest was accounted for by different forms of hard currency clearing.

The main reason for this is the reduction of liquid fuels export sales, owing to the difficulties facing the Soviet oil industry. According to the USSR State Committee for Statistics (GOSCOMSTAT), compared with January-September 1989, crude oil and condensate production over the first nine months of 1990 fell by 23.5 million tonnes or by 5.1 percent. Crude oil exports fell by 6.3 million tonnes or by 6·6 percent, gasoline exports by 2·1 million tonnes or by 38.9 percent, gas/diesel oil export by 2.2 million tonnes or by 12.9 percent, fuel oil exports by 2.3 million tonnes or by 12.4 percent.

If this trend continues, Soviet liquid fuel exports would be at least 10 percent below 1989 figures (184·7 million tonnes).

Product purchases

Moreover, for the first time in the postwar period, the Soviet Union started buying petroleum products in the world market. According to unofficial figures, this country bought some 400–500,000 tonnes of gasoline whose price at the begining of October ($450/tonne) was 80 percent higher than at the beginning of August. The deal was worth some $150–200 million. Hence, a part of additional oil export revenues is spent on importing petroleum products.

The export of natural gas can bring in additional profit because its price has been tied in with the price of crude oil and petroleum products. However, the lag between the variation of the two prices is three to six months and the relationship between the price of oil and products and the price of gas is not a direct one. That is why additional earnings from gas exports caused by changes on the oil market will not be notable.

The Iraqi invasion of Kuwait had increased the price of gold by some $30 per ounce but afterwards the price returned to the level of the beginning of August. If Soviet gold exports remained at their current levels (296 tonnes in 1989 according to Western sources) this should bring this country an additional revenue of some $125 million at maximum which however has already been eaten up by the purchase of gasoline mentioned above.

On the whole, the additional earnings of the Soviet Union through the price increases in the main export markets will be considerably below $3 billion.

Soviet losses

And what are the USSR losses caused by the crisis in the Gulf? Unfortunately there are no agreed figures here either. Various Soviet specialists have published their different estimates of the UN embargo consequences for this country.

In an interview to the newspaper *Sovetskaya Rossiya* issue of 26 August, Mr Katushev, the Minister of Foreign Economic Relations of the USSR, has indicated three categories of these losses (cancellation of civil export and arms supplies to Iraq and of import of Iraqi crude) and has made estimates for the two latter. 'Elimination of crude import for the total value of 800 million roubles will lead to a loss of goods for the Soviet domestic market . . . at total value of almost 2 billion roubles', declared the minister. Referring to the Stockholm International Peace Research Institute (SIPRI) data, he has estimated the total cumulative value of Soviet arms supplies to Iraq equal to some $12 billion. But he remarked

	1988	*1989*
Total billion roubles, including (in percent)	67.1	68.8
Machinery, equipment & vehicles	16.2	16.4
Fuel and electricity of which:	42.1	39.9
crude oil & petroleum products	29.4	27.1
Ores & concentrates, metals & their articles	9.5	10.5
Chemical products, fertilisers & rubber	4.0	4.0
Wood materials, pulp & paper articles	3.5	3.5
Textile raw materials & half-finished products	1.6	1.6
Food products & raw materials for their production	1.7	1.6
Consumer goods	2.8	2.6

Figure 2: USSR export structure, 1988–1989 (in all destinations, in current prices)

Item	Size of decrease	
	mln tonnes	*in percent*
Crude oil & condensate production	−23.5	−5.1
Crude oil export	−6.3	−6.6
Gasoline export	−2.1	−38.9
Gas/diesel oil export	−2.2	−12.9
Residual fuel oil export	−2.3	−12.4

Figure 3: USSR oil industry figures in January-September 1990 compared with the same period in 1989

Source of estimate	Value of 1990 gross losses	
	on an annual basis	*through the period of embargo (August-December)*
K Katushev (author's recalc)	$1.9–2.1 bln	$0.8–0.9bln
A Belonogov	—	$0.915bln
A Kondakov	—	near $1bln
Ju Savinov & A Prokhorenko	—	$1.3bln
Author's estimate	—	$1.7–1.8bln
I Mordvinov	$6–7bln (?)	$2.5–2.9bln (?)

Figure 4: The USSR gross losses caused by the crisis in the Gulf according to various Soviet specialists

that, 'The Soviet-Iraqi cooperation in the military field had begun as far back as in 1958; therefore this sum needs to be distributed for more than 30 years'. Let us add to these figures the value of 1989 civil exports to Iraq and re-calculate roubles into dollars using the official exchange rate. That will give us, according to Mr Katushev, the cumulative annual value of USSR losses equal to $1.9–2.1 billion. That means that for the period August-December (embargo period), these losses will be equal to $0·8–0·9 billion.

Addressing the Committee on Foreign Affairs of the USSR Supreme Soviet, Mr Belonogov, USSR Deputy-Minister of Foreign Affairs, declared on 30 August that 'As a result of sanctions against Iraq . . . our 1990 losses will be equal to $800 million consisting of current payments and missing supplies of Iraqi oil, the latter being re-exported to India, Bulgaria, Romania and Yugoslavia. We are failing to receive $115 million from occupied Kuwait'. Hence, according to Mr Belonogov, Soviet losses during August-December period will be equal to $915 million.

Mr Kondakov made a similar estimate for the USSR losses from the crisis in the Gulf. In his articles in *Novoye Vremya* and in *Ekonomia i zhizn,* he wrote that, 'Direct losses as a result of sanctions against Iraq and the occupation of Kuwait (missing supplies of oil in repayment for the credits, available current payments, lost property and unpaid supplies in Kuwait, expenditure on evacuation of Soviet citizens) will amount to nearly $1 billion in the current year and not less in 1991'.

On 21 August a situation analysis was held in the All-Union Scientific and Research Institute of Market Studies attached to the USSR Ministry of Foreign Economic Relations entitled, 'The consequences of Iraqi invasion of Kuwait for the USSR foreign economic relations'. Its participants, Mr Savinov and Mr Prokhorenko, published the main results of the discussion in *NTR: tribuna* weekly. They estimated the direct economic losses of the Soviet Union up to the end of the year amounting to $1.3 billion ($0.5 billion is the cost of missing Iraqi oil supplies in repayment for its obligations; $0.8 billion represents total losses from the cancellation of Soviet exports to Iraq and from recall of Soviet specialists working in joint ventures).

My estimate of the USSR direct foreign trade losses up to the end of last year, published in the *Commersant*, was equal to $1.7–1.8 billion at minimum.

While commenting in the *Trud* newspaper, the issue of 23 October, Mr Mordvinov, the Head of Department of Press and Information, USSR Ministry of Foreign Economic Relations, has estimated the total value of Soviet damages, concerned with the loss of such rich clients as Iraq and Kuwait, close to $6–7 billion. However, he did not disclose the breakdown of this sum, nor the period for which those calculations were made. Let us suppose that these figures were calculated on an annual basis. That means that for the five months period (August-December), the corresponding figure will be equal to $2.5–2.9 billion.

Let us try to agree a figure. For that purpose an item-by-item accounting of the USSR direct losses is needed.

According to the SIPRI data, which was also published in the Soviet press, between 1980 and 1989 the USSR has supplied Iraq with $13.25 billion worth of arms. Taking into account the fact that in 1980–82, when Iraq attacked Iran and waged a war on the latter's territory, Soviet arms supplies were interrupted, the average annual sales of arms to Iraq over that whole period can be estimated at $1.7–1.9 billion. (Prof Goldman estimated 1989 sales of Soviet arms to Baghdad at $1.5 billion and Messrs Savinov & Prokhorenko at $3.0 billion). Thus, cancelling arms supplies to Iraq, the USSR would be missing up to the end of 1990 some $0.7–0.8 billion ($0.6 billion — according to Prof Goldman; $1.25 billion — according to Messrs Savinov & Prokhorenko).

Various official publications estimate the value of Soviet 'civil' exports to Iraq in 1989 at between 107.9 and 255.4 million roubles. Other estimates also exist. Thus, on this item the USSR direct losses may reach by the end of 1990 an estimated 45 to 105 million roubles. In terms of the official exchange rate ($1 = Rb0.6), this would amount to $75–175 million. Taking into account the triple devaluation of the rouble and the introduction of its commercial exchange rate as of 1 November ($1 = Rb1.8), the losses

Item, destination	Price, rouble per tonne
Average USSR import price of Iraqi crude oil	81.5
Re-export price of Iraqi crude oil in supplies to:	
India	75.4
Bulgaria	109.1
Romania	112.1
Yugoslavia	83.5

Figure 5: 1989 import price of Iraqi oil and its re-export price to different countries

can be estimated at $55–130 million.

Soviet imports from Iraq were estimated by official sources at 975·9 million roubles in 1989. Most of that value was accounted for by oil supplies as payments for 'special cooperation' (11.9 million tonnes at a price of 81.5 rouble per tonne). All oil imported from Iraq has been re-exported to India, Bulgaria, Romania, and Yugoslavia, as was indicated earlier. By the way, the price of oil re-exported to India in 1989 (75·4 rouble per tonne) was lower than the import price of Iraqi oil; in the case of Yugoslavia these prices were nearly equal (83.5 roubles per tonne of re-exported oil); and in the case of Bulgaria and Romania the price of re-exported oil (109.1 and 112.1 rouble per tonne respectively) was significantly higher than the import price of Iraqi oil.

Commitments

As Mr Mordvinov declared, taking into account the problems facing the Soviet oil industry, the foreign trade agency Soyuzneftexport is unable to fulfil its obligations to East European nations. That reduction will not apparently extend to India. Under the Soviet-Indian trade agreement, the USSR should have supplied 4.5 million tonnes of oil to India from the Iraqi Basra oilfield in the period between April 1990 and March 1991. The official spokesman for the Soviet Embassy in New Delhi has said that the USSR will meet that obligation regardless of the developments in the Gulf. 'Where shall we take this oil from is our own business. But India will receive this oil and 2.8 million tonnes of petroleum products also', declared, according to Reuter, Mr Granovsky, Economic Counsellor of the Embassy.

There are some possible (even if in theory) scenarios where this oil can be taken from. It can be taken from the domestic market; or through further decrease of our supplies to COMECON countries (still being carried out on the transferable rouble basis) or to Western countries (on the hard currency basis); or through the purchasing of missing quantities in the world market. Though it seems that the second scenario became preferable for decision-makers, from my point of view the loss from missing supplies of Iraqi oil needs to be calculated in any case on the marginal basis, that means in terms of world market prices. If we go by the assumptions used with respect to Soviet oil exports, the compensation of the re-export of Iraqi oil should cost the USSR $1.06 billion before the end of 1990.

	$ bln value of:		
Items	*benefits*	*losses, using Rb/$ exchange rates: official*	*commercial*
Price increases in USSR export markets:			
crude oil	1.5		
petroleum products	1.5		
natural gas	negl		
gold	0.125		
Foreign markets lost due to UN embargo:			
arms sales		0.7–0.8 (0.6 to 1.25)	
civil export to Iraq		0.075–0.175	0.055–0.130
re-export of Iraqi crude		1.06	
trade with Kuwait		0·08	0·06
Subtotals	**3.125**	**1.9–2.1**	
		(1.8–1.9–2.4–2.6)	
Gasoline purchase		0.15–0.20	
Total	**well below $1 bln**		

Figure 6: The balance of the USSR 1990 direct foreign trade gross benefits and losses as a result of the crisis in the Gulf

Soviet-Kuwait relations

Soviet exports to Kuwait amounted to 117.4 million roubles in 1989, while imports hovered just over zero mark. The loss of that market is equivalent to USSR damages equal to $80 million, according to the official exchange rate, or $60 million taking into account the introduction of the commercial rouble exchange rate as of 1 November.

The Soviet Union could have lost a lot more from the termination of financial and economic cooperation with Kuwait. It began in 1987, when Kuwaiti banks contributed to a $150 million loan to the Soviet Union. In May 1990 an agreement was signed under which the Kuwait Foreign Trading, Contracting & Investment Company gave the USSR Vnesheconombank a credit of $300 million for seven years. As was indicated above, at this point $115 million remains outstanding, although the USSR will according to all signs receive it. The lawful government of Kuwait in exile controls the foreign financial assets of the country estimated at more than $100 billion. It believes that after the banking system of the country begins to operate under new circumstances it should meet all of its foreign obligations, that means including the deal with the Moscow bank.

Under the agreement between the two countries, Kuwait assumed the obligation to subsidise the Soviet oil industry in a number of frontier areas of Siberia and the Arctic zone and extend other kinds of financial assistance to the Soviet Union. Taking into account the Kuwait government's stand, there are grounds to believe that cooperation with Kuwait will continue, although it may be expected to decline.

Conclusion

The total losses of the Soviet Union as a result of the crisis in the Gulf, therefore, should amount to $1.9–2.1 billion in 1990 or from $1.8–1.9 to $2.4–2.6 billion if alternative information about Soviet arms supplies to Iraq is used. One must add to this the expenses incurred in evacuating Soviet citizens from Iraq and Kuwait and the cost of lost property.

Therefore, the Soviet Union is at this point not affected directly by the crisis in the Gulf since additional oil revenues are above the losses. In 1990 the difference will be well below $1 billion of net benefit, with the potential gain estimated at between $0.5 and $1.15 billion. But the size of this net benefit is not so big as one imagines at first glance, taking into account in particular the problems of the Soviet energy sector on the eve of the winter: a few purchases of petroleum products as at the begining of the autumn will be quite enough to vanish all these windfall petroleum revenues. ■

This paper was presented to the conference, 'Energy and the New Europe: the Global Dimension', convened in December by the Royal Institute of International Affairs, the British Institute of Energy Economics and the International Association for Energy Economics.

Conference Report

Safe road transport in the petroleum industry

The Conveyance Panel of the Institute of Petroleum's Marketing Sub-Committee, which has played a major role in establishing present-day safety standards in the transport of petroleum products by road, organised this conference in November to provide a forum for the discussion of developments in this important area of oil industry activities which are being occasioned by a variety of factors, including advances in technology, the increasing awareness generally of safety and environmental issues and the approach of 1992.

The proceedings of this conference, to be published shortly, will be available from the IP Library.

In his keynote address, Mr D C T Eves, Deputy Director General, Health and Safety Executive, said, 'My message to the petroleum industry is that you are doing well in transporting your products safely by road — but you dare not allow a good record to lead to complacency. Over the last 20 years the number of persons killed by the transportation of petroleum products has averaged under one per year; and for dangerous substances as a whole, the figure has been less than two out of about 5,000 persons killed on the roads each year. But the potential for trouble is high; and however good the record, there is always room for improvement. This conference will illustrate some of the ways and new developments by which improvements are being made. HSE has been involved in a number of these.'

With the increased traffic densities and the higher road speeds experienced today, it is important that road tankers used to convey petroleum products continue to incorporate the latest technology in design and construction in order to improve on the already high standard of safety enjoyed in the industry.

In delivering the keynote address, Mr David Eves, Deputy Director General of the Health and Safety Executive, congratulated the petroleum industry in the United Kingdom on its safety record and on its continued efforts to improve safety of operations, but cautioned against complacency.

Recent large-scale checks in one area of the country had shown that some 25 percent of the 400-plus road tankers carrying dangerous substances were to some degree breaking regulations governing the safe transport of such goods.

Increased vigilance must be the order of the day, and the Institute of Petroleum's Safe Loading Pass is a positive step in ensuring that third-party vehicles do not present a hazard whilst loading in terminals and are correctly equipped with requisite safety features.

Whilst vehicle and tank design continues to develop improved safety in operation, we must not lose sight of the fact that all vehicles are only completely safe when parked up; once vehicles are taken onto public roads and customers' premises the possibility arises of accidents caused by the actions of third parties or by driver error.

Better standards of driver selection and training are necessary, and there is considerable scope for further research in this field. The industry must devote its efforts to these areas as the majority of road accidents are caused by human error.

Better driving, in addition to reducing accidents, also reduces fuel consumption and wear and tear on the vehicle, both important areas of saving in today's economic climate.

The 120 delegates attending the conference joined with the speakers in active discussion of all the topics, and the conference was judged a considerable success and a significant contribution towards the industry's aim of improved road safety.

BL Veale,
Transport Engineering Manager, BP Oil Europe

Exhibition of related equipment on show during the conference.

IP Conference on Safe Road Transport in the Petroleum Industry

Chairman: Mr BL Veale, Transport Engineering Manager, BP Oil Europe

PAPERS

Opening Keynote Address
Mr D Eves, Deputy Director General, Health and Safety Executive

Developments in Vehicle Design
Mr Gerrard, Foden Trucks

Tank Design
Mr C Farmer, Charles Roberts Ltd

Vehicle Equipment
Mr TJ Poulter, The Drum Engineering Company Ltd

Industry Overview
Mr KH Camplin, BP Oil Europe

High-Level Cut-Off Capability — Case for an International Standard
Mr PG Edgington, Consultant

Vehicle Maintenance and the Safe Loading Pass Scheme
Mr AG Stowe, Consultant

Driver Controlled Deliveries
Mr MGL Sewell, Health and Safety Executive

An Oil Company's View of Benefits of On-Truck Information Systems
Mr S Cotton, Shell International Petroleum Co Ltd

Current Available Technology and Future Trends
Mr A Mikkelson, Sam-Systems A/S, Denmark

Recruitment
Mr JE Searle, Wincanton Distribution Services Ltd

Training
Mr RJ Barnard, Petroleum Training Federation

Data capture and communications

By A Mikkelson, Sam-System A/S, Denmark

Electronics and on-truck computers utilised on road tankers are relatively new, and the possibilities of this technique with regard to safety, efficiency and product quality assurance are just about to be discovered and introduced in the industry.

A lot is happening in the area of safe road transport of petroleum products. Looking at the distribution chain of petroleum products a lot of effort has been put into the automation of the depots with sophisticated computerised dispatching and depot automation systems, not to forget product control activities with lab samples, etc.

Also the forecourts are on the move with integrated till, dispenser and credit card reader systems, communicating with a mainframe computer in the headquarter.

Overspill protection systems are also slowly being introduced for environmental reasons.

The truck seems to be the last part to be included, so living up to the modern age's demand for control of efficiency and quality assurance of products under transport.

What technology is available for the truck? The module based On Truck Computer System is increasingly being used in order to cover some of the application requirements previously mentioned.

The system consists of the following:

a) Portable Computer module (PORTAMAT). This module communicates with the main computer system and vehicle based equipment and can contain loading and discharge information, e.g. addresses, fuel types, storage tank or compartment, depot and station ID, price information, loading or discharge guidelines and warnings. On return to base the relevant information from the loading unloading process will be transferred back to the depot/main computer system.

b) Tacho, VIS module. All data regarding start, stop, speed, distance driven, engine revolution, own fuel consumption and ABS in use are stored in the computer module.

c) Control modules can supervise a long range of sensors giving information on the position of valves, faucet bars, manholes, high and low level, air pressure in the pneumatic system, etc. Moreover, it can control the API or foot valves.

d) Control modules can read product and station ID's on the depot as well as the forecourt, and be integrated with forecourt overspill protection devices.

e) Point of Sale (POS) modules can print out delivery notes or invoices in the truck.

f) Litre Counter modules can meter the products and supply information to the POS module or main base. The module can be integrated in high efficient pumping packages.

g) Communication can be made by
- infra-red data communication
- radio based data communication
- satellite data communication

All these capabilities can help us prevent cross overs, spillages, electronically seal the tankers, substantially reduce pilfering, issue 100 percent correct (calculated) delivery notes or invoices at the time of delivery, secure faultfree data transfer between vehicle and home base. As the computer system logs and identifies all that the driver has done, both product and delivery security are well taken care of by the system. If radio based data transmission is being used, the vehicle does not necessarily have to return to base on a frequent basis.

The different application areas are described more specifically below.

1. Driver Controlled Deliveries or Sealed Delivery Systems

In order to satisfy the authorities and customers and take away the necessity for the driver to climb the tanker, the following modules must be installed: Portamat, VIS, POS and control modules.

The basic idea is to turn the tanker into something similar to a can of beer or a bottle of milk where no measurement at purchase is necessary.

The Portamat has been loaded with all delivery information, address, fuel types, volumes and tanker loading pattern. When the driver starts loading at the depot the OTC will identify the API loading hose and its product ID. The tanker valves will only be released if product ID corresponds with that of the loading pattern by compartment.

When all compartments are filled, the volume measured by the depot meter per compartment will be fed into the OTC computer (Portamat). As soon as the vehicle is disconnected and drives off all valves and manholes are sealed electronically. During transport all activities are logged. Arriving at the customer end the driver will have to make connection to the forecourt which will send its ID (product and address), thereby securing that

products are delivered at the correct address and tank.

When the compartment runs empty and the wetleg detector has confirmed that, a delivery note can be issued based on the data from the depot.

Advice in the form of warnings and discharge information can be kept in the Portamat in order to help the driver when discharging and all transport data is fed back to the dispatching system.

All the above-mentioned functions make pilfering extremely difficult.

2. Cross-over Prevention

Cross-over Prevention (COP) stand alone (non communicating) can be established by using control modules only (TBBM). Arriving at the forecourt the driver will connect up to the product ID device and the overspill device. Unless product ID corresponds to that of the compartment to be emptied the valves will not be released.

Should a high level be reached in the forecourt tank a signal will be sent to the OTC module which will cause the API or foot valve to close and thereby prevent a spillage. If wetleg detectors are installed and a compartment is not empty, the system will prevent a new loading to take place unless the product is similar.

By using this technique product mixing can be prevented which is very important as leaded gasoline can destroy catalytic converters completely. The two applications Driver Controlled Deliveries (DCD) and Sealed Delivery System (SDS), and COP are very similar so if COP is installed it is simple to extend it to DCD or Sealed Delivery System or vice versa.

3. Point of sale

This consists of Portamat, VIS (Tacho) and Litre Counters with temperature compensation. Similar to DCD the Portamat is loaded with all delivery information e.g. names, addresses, prices, products, etc. When a delivery has been carried out, an invoice is printed with all relevant information, rebates, etc. The savings are substantial, faster payments, saving of stamps, automatic data transmission, price calculations are always accurate and precise and if radio communication is used, the driver can go to unmanned depots for reloading as his new tour will be transmitted directly to the computer in the cab. At the end of a shift all relevant data is transmitted back to base. This includes tacho and administrative data plus information

A Mikkelson

regarding volumes still contained on the vehicle. The possibilities for pilfering are again reduced considerably and the overall performance for the vehicle can be followed closely. Drivers serving remote areas can therefore save costly empty rides to main base.

4. Vehicle Information System

The Vehicle Information System (VIS) module is used to monitor the vehicles' efficiency and to monitor whether the transport, loading and discharge times are as efficient as they can be. The system logs speed, distance, engine revolution, own fuel consumption, and ABS. Alarm levels can be set for speed, engine rev's, etc, which will be reported to the management.

The VIS is always an inherent part of POS, DCD (SDS) and extended COP and will log and report any deviation from the planned delivery, e.g. deviations from route, unplanned valve opening patterns, unexpected stops, etc.

User benefits

These systems can provide the oil companies and the management with a control over their tanker fleet which they have never had before. Today when a vehicle leaves the terminal the transport manager has little or no control at all. The information that can be retrieved from the Tachograph chart are far from satisfactory.

An OTC system can secure that products are delivered correctly and safely. Moreover, it will report all activities during loading, transport and discharge giving proof to vendor and customer that the products were delivered according to the agreed specification for price, quantity, quality and safety.

The data gathered in the main computer can also be used by the fleet manager to get an overview and improve fleet efficiency. The above is based on current available modules, all in use on the continent in one form or another. VIS is currently being introduced in the United Kingdom as well as Litre Counters in modern pumping units and radio based POS units.

It is my belief that these OTC systems will very quickly find their way into the road tanker business as they offer a tool to increase safety, prevent cross over and contamination especially with regard to leaded and unleaded fuel.

Future trends

OTC system will be a lot more streamlined and new facilities will be added, such as supervision of tyre pressure, engine temperatures, brake temperatures, lube oil condition, etc. Therefore we will not only get access to the previously mentioned advantages, but we can also get maintenance planning data back from each vehicle automatically.

When the European radio telephone network becomes a reality in 1993 all road tankers can be made online even when they carry out cross border deliveries.

Instead of using radio telephone for data transmission, satellite communication will become an economical and sensible alternative adding an interesting feature, namely determination of vehicle position. The position is as precise as within a radius of 25 meters. Satellite communication is on the move and is already used on several thousand trucks in the United States, and even in a small country like Denmark 20 systems are currently being tested.

I hope by the above to have proved that the use of OTC systems is an important addition to safety in the transport of petroleum products. The investment in this new technology brings not only safety but also savings and efficiency.

Let me end by saying that we are not talking about the future of tomorrow but the future of today. Let us get on with it! ■

Oil Industry Nurses Symposium

The 7th Biennial Oil Industry Nurses Symposium was held at the Institute of Petroleum on 27 and 28 September 1990. This conference was once again organised by Ann Woods (BP), Sally Deaves (Shell) and Sally Dymott (Esso). It has become an important meeting for occupational health nurses and the high standard of papers resulted in the attendance of colleagues from the United Kingdom, Europe, the Middle East and nurses from other industries in the United Kingdom.

Sally Dymott said with post-registration, education and practice reform shortly to be introduced, these symposia are important learning grounds for highlighting topics to further nurse education. Considerable effort goes into the organisation of these symposia which require long-term planning and that she and her two colleagues were, therefore, already embarking on the agenda for the 1992 conference.

Dr John Brothwood, Chief Medical Adviser at Esso UK plc, gave the keynote address which set the scene and introduced the themes reflected by subsequent speakers. He talked about the previous decade, of downsizing, tremendous change, increased accountability and the effects of new technology on occupational health practice. The emphasis over the next 10 years will be on our companies' most important asset, the employee. A renewed and enthusiastic approach will be made towards individual and corporate fitness and the management of the demands of change, with particular regard to the human factor in health and safety.

As brokers for both management and employees, achieving these goals will place further demands on occupational health services and nurses must continue to be ready to fulfil the role. To be prepared, professional updating must be maintained and epidemiological studies must continue.

Ruth Alston, Education Officer for the English National Board, discussed the way forward in education, strategies on how to cope with change, new approaches to analytical thinking, the essential need for education beyond registration and the importance of constant updating of knowledge and skills relating to current needs. All these skills combined with a single mindedness of purpose and commitment are essential. Parameters need to be set for the future, having regard for the implication for nursing practice.

Reg Pyne, Director of Professional Conduct at the United Kingdom Central Council, spoke on 'Accountability and the Code of Professional Conduct'. It is encumbant on all registered general nurses to act at all times in such a manner as to justify public trust and confidence, to uphold and enhance the good standing and reputation of the profession, to serve the interests of society, and above all, to safeguard the interests of individual patients and clients. They are accountable for their actions and the exercise of professional accountability.

Eleanor Wilson of BP gave a graphic account of the problems of take-overs in relation to employees. She highlighted the expectations and consequences that result from an organisational takeover.

Bill Morgan, Senior Medical Supervisor from Shell, gave details of their upstream pharmacopoeia – how it came into being, its administration and control and the effects of recent legislation.

Cynthia Attwell, Chairman, Occupational Health Committee, English National Board, gave an occupational health nurse's insight into the European Community with the Social Charter 1989, a number of health and safety issues for 1992 and the effects on occupational health practice.

A consultant analytical, toxicologist, David Berry, spoke on testing for

Miss Sally Dymott, Chief Nursing Officer, Esso Petroleum Co Ltd, Mrs Sally Deaves, Senior Nursing Officer, Shell Haven refinery, Miss Ann Woods, Senior Nursing Officer, BP International Ltd.

Mrs Eleanor Wilson, Regional Nursing Officer, BP Exploration Ltd, Glasgow, and Miss Dymott.

drugs of abuse, and its relevance in the management of health and safety in the workplace.

Paul Jennings from BP gave a fascinating glimpse into the development of commerce and recent increases in business opportunities which have resulted from the economic and political reforms in the Soviet Union.

Topics discussed by the Senior Law Lecturer at the University of Manchester, Mrs Diana Kloss, in her presentation 'Legal Issues in the Workplace' included negligence, legal and ethical rules of biological screening both before and during employment, and contracts of employment in relation to sickness absence and dismissal.

The social event of the symposium was the conference dinner. The guest speaker was the Rev Andrew Wylie, Chaplain to the Scottish Churches Industrial Mission with responsibility for the North Sea Oil Industry, and also Honorary Fellow of the Institute of Petroleum. He saw the work of the nurse as similar in many ways to his own. He identified areas of common interests, the care of people and the importance of seeing them as individuals with all their own particular needs, a total holistic approach to care.

In summarising, Ann Woods commented that throughout the entire conference, the nurses, in various ways, had been discussing times of change and the care of people. She said, 'We are in the people business'. It was up to the nurses to support the workforce and management and to be prepared to meet the demands that the future trends impose. To do this, nurses must have the education, knowledge, skills and flexibility to undertake this role. ■

FORTHCOMING EVENTS

January

16th
London: Conference on 'Geology and Drilling — A new age of cooperation'. Details: Heidie Gould, Petroleum Group, The Geological Society, Burlington House, Piccadilly, London W1V 0JU. Tel: (071) 434 9944. Fax: (071) 439 8975.

17th
London: Lecture on 'Retro-fitting subsea valves in gas pipelines without flooding' by Mr WJ Newman, Shell Exploration and Production. Details: Mr AA Reed, Secretary, The Pipeline Industries Guild, 17 Grosvenor Crescent, London SW1X 7ES. Tel: (071) 235 7938.

21st-25th
Trondheim, Norway: Course on 'Design and analysis of slender marine structures — risers and pipelines'. Details: WEGMT Secretariat, The Marine Technology Directorate Limited, 19 Buckingham Street, London WC2N 6EF. Tel: (071) 321 0674. Fax: (071) 930 4323.

21st-22nd
London: Course on 'North Sea Economics'. Details: DCA Consultants Ltd, Rosewall Cottage, Main Road, Aberuthven, Perthshire PH3 1HB. Tel: (0764) 63936.

23rd
London: Conference on 'Chemicals, Labelling and the Environment'. Details: Conference Secretariat, SCI, 14/15 Belgrave Square, London SW1X 8PS. Tel: (071) 235 3681. Fax: (071) 823 1698.

29th-30th
Edinburgh: Conference on 'Oil and Gas European Export Technology'. Details: Natalie Cox, IBC Technical Services Limited, Bath House (3rd Floor), 56 Holborn Viaduct, London EC1A 2EX. Tel: (071) 236 4080. Fax: (071) 489 0849.

29th-30th
Haugesund, Norway: 'Gas Transport Symposium'. Details: Norwegian Petroleum Society, PO Box 95, N-5049 SANDSLI, Norway. Tel: (05) 22 48 85. Fax: (05) 22 89 70.

Call for Papers

The conference 'SUBTECH '91 — Back to the Future' will be held between 7–9 November 1991. The conference will demonstrate how current technology using ROV and diver intervention is based on the knowledge gained over the years.

Papers are sought which should start off with a short introduction to put it into historical perspective, giving a brief outline of 'this is how we used to do it', following through to 'lessons learned', giving a graphic, high quality presentation on 'these are the reasons why we do it this way now', leading on to show how the future should be shaped as a result of this experience.

Papers are invited on the following broad subject areas:

- ★ **Safety**
- ★ **Are we going overboard with inspection?**
- ★ **Pipelines**
- ★ **Subsea field developments**
- ★ **Tomorrow's world**

Abstracts of 200–300 words should be submitted to SUT, 18 Farburn Terrace, Dyce, Aberdeen AB2 0DT by no later than 31 January 1991.

February

5th-6th
Esher: 'The Safety and Health at Work Exhibition and Conference'. Details: Caroline Fletcher, Paramount Exhibitions and Conferences, Paramount House, 17–21 Shenley Road, Boreham Wood, Hertfordshire WD6 1RT. Tel: (081) 207 5599.

6th-7th
London: Conference on 'Tectonics and Seismic Sequence Stratigraphy'. Details: Heidie Gould, Petroleum Group, The Geological Society, Burlington House, Piccadilly, London W1V 0JU. Tel: (071) 434 9944. Fax: (071) 439 8975.

7th-8th
London: Conference on 'Integrated Pollution Control'. Details: Liz Hyde, IBC Technical Services Ltd, Bath House (3rd Floor), 56 Holborn Viaduct, London EC1A 2EX. Tel: (071) 236 4080. Fax: (071) 489 0849.

11th-14th
Cranfield: Course on 'Introduction to Flow Measurement'. Details: Short Course Unit, Department of Fluid Engineering and Instrumentation, School of Mechanical Engineering, Cranfield Institute of Technology, Bedford MK43 0AL. Tel: (0234) 752766. Fax: (0234) 750728.

12th
London: Lecture on 'Pipeline Engineering in an EPC Environment-Pipeline Gas Utilisation Project Stage II — Malaysia' by L Gray, IMEG. Details: AA Reed, Secretary, The Pipeline Industries Guild, 17 Grosvenor Crescent, London SW1X 7ES. Tel: (071) 235 7938.

13th
London: 'International Exploration Highlights'. Details: Heidie Gould, Petroleum Group, The Geological Society, Burlington House, Piccadilly, London W1V 0JU. Tel: (071) 434 9944. Fax: (071) 439 8975.

13th-14th
London: Conference on 'The Future of Britain's Estuaries'. Details: Ruth Day, RSA Environment Section, 8 John Adam Street, London WC2N 6EZ. Tel: (071) 930 5115.

17th-20th
Tripoli, Libya: Mediterranean Offshore Conference. Details: C Ramsden, Jawaby Oil, 33 Cavendish Square, London, W1M 9HF. Tel: (071) 499 0855. Fax: (071) 499 1771.

18th
London: Seminar on 'Financing Energy Projects'. Details: Miss Susan Ashton, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Tel: (071) 636 1004. Fax: (071) 255 1472.

19th
London: Seminar on 'Oil Price Information'. Details: Mrs Jean Etherton, The Institute of Petroleum.

21st-22nd
Edinburgh: Conference on 'Advances in Reservoir Technology'. Details: Natalie Cox, IBC Technical Services Limited, Bath House (3rd Floor), 56 Holborn Viaduct, London EC1A 2EX. Tel: (071) 236 4080. Fax: (071) 489 0849.

FORTHCOMING EVENTS

25th-1st March
Aberdeen: Course on 'Petroleum Exploration and Development Economics'. Details: DCA Consultants Ltd, Rosewall Cottage, Main Road, Aberuthven, Perthshire PH3 1HB. Tel: (0764) 63936.

26th
London: Conference on 'Profiting from Low-Grade heat'. Details: Geraldine Oliver, Information Manager, The Watt Committee on Energy, Savoy Hill, London WC2R 0BU. Tel: (071) 379 6875. Fax: (071) 497 9315.

March

4th
London: Conference on 'Engineering Opportunities in the Ocean Technologies'. Details: Debby Seddon, British Committee for Engineering on Oceanic Resources, c/o SUT, 76 Mark Lane, London EC3R 7JN. Tel: (071) 481 0750. Fax: (071) 481 4001.

4th-7th
Chislehurst: Three courses on 'Safety of Electrical Equipment in Potentially Explosive Atmospheres'. Details: Sira Communications Ltd, South Hill, Chislehurst, Kent BR7 5EH. Tel: (081) 467 2636. Fax: (081) 467 7258.

6th
London: Conference on 'Safety in Refining and Petrochemical Plant'. Details: Dr Robert Owen, Technology Forum, Stanley House, Stanley Avenue, Wembley, Middlesex HA0 4JB. Tel: (081) 900 1555. Fax: (081) 900 1134.

6th-8th
London: Course on 'Offshore Pipeline Engineering'. Details: Nadia Ellis, IBC Technical Services Limited, IBC House, Bath House, (3rd Floor), 56 Holborn Viaduct, London EC1A 2EX. Tel: (071) 236 4080. Fax: (071) 489 0849.

Call for Papers

'Offshore Europe 1991' is being held in Aberdeen between 3–6 September 1991. Papers are invited on the following broad subject areas:

- ★ **Formation evaluation**
- ★ **Reservoir modelling and analysis**
- ★ **Integrated field development**
- ★ **Drilling technology**
- ★ **Production technology**
- ★ **Horizontal well technology**
- ★ **Information technology**
- ★ **Operational safety**
- ★ **Environmental protection**
- ★ **Business aspects**
- ★ **Case histories**

A 200 word abstract of proposed papers should be submitted by 15 February 1991 to Offshore Europe '91, 55–59 Fife Road, Kingston upon Thames, Surrey KT1 1TA. Tel: (081) 549 5831. Fax: (081) 541 5657.

18th-22nd
Zurich, Switzerland: Course on 'Multiphase Flow and Heat Transfer: Bases, Modelling and Applications in (a) The Nuclear Power Industry and (b) The Process Industry'. Details: Professor G Yadigaroglu, ETH-Zentrum, CH-8092 Zurich, Switzerland. Tel: (41) 12564615.

19th-21st
Edinburgh: Conference on 'Effective Industrial Membrane Processes — Benefits and Opportunities'. Details: Conference Department, Membrane Conference, BHRA, The Fluid Engineering Centre, Cranfield, Bedford MK43 0AJ. Tel: (0234) 750422. Fax: (0234) 750074.

20th-22nd
Gaithersbury, Maryland, USA: 'International Workshop on Reliability of Offshore Operations'. Details: Lori Phillips, National Institute of Standards and Technology, Building 101, Room A902, Gaithersbury, MD 20899, USA.

April

3rd-5th
London: Conference on 'Coal in the Environment'. Details: World Coal Institute, Conference and Exhibition Secretariat, 8 Cotswold Mews, Battersea High Street, London SW11 3JE. Tel: (071) 937 4600. Fax: (071) 376 0453.

8th-12th
Leeds: Course on 'Diesel Particulates'. Details: Mrs CP Shirley, Department of Continuing Professional Education, The Adult Education Centre, Springfield Mount, Leeds LS2 9NG. Tel: (0532) 333226. Fax: (0532) 333240.

16th-17th
London: Conference on 'Developing and Financing Profitable Self-Generation Projects'. Details: IIR Limited, Industrial Conferences Division, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1BR.

16th-17th
London: Conference on 'Clearing the Air'. Details: Virginia Hopes, Status Meetings Ltd, Festival Hall, Petersfield, Hampshire GU31 4JW. Tel: (0730) 66544. Fax: (0703) 68865.

22nd-23rd
Bergen, Norway: Conference on 'Business Risks in the Oil Industry'. Details: The Bergen Conference on Oil and Economics, The Norwegian Petroleum Society, Ms Gerd Jaeger, (Conference Director), PO Box 95, N-5049 SANDSLI, Bergen, Norway. Tel: (475) 224885. Fax: (475) 22 89 70.

23rd-24th
Birmingham: Course on 'Understanding Heat Treatment'. Details: Wolfson Heat Treatment Centre, Aston University, Aston Triangle, Birmingham B4 7ET. Tel: (021) 359 3611 ext. 5212. Fax: (021) 359 8910.

May

3th-15th
Singapore: 'Asian Natural Gas III — New Markets and Distribution Methods'. Details: Institute of Gas Technology, 3424 South State Street, Chicago, Illinois 60616, USA. Tel: (312) 567 3650. Fax: (312) 567 5209.

18th-20th
Dijon, France: Symposium on 'Mesozoic and Cenozoic Sequence Stratigraphy of European Basins'. Details: T Jacquin, Centre des Sciences de la Terre, Université de Bourgogne, 6 Bld Gabriel, 21100 Dijon, France. Fax: 80395066.

21st
London: Conference on 'Bioremediation of Industrial Sites'. Details: Caroline Little, The Institute of Petroleum.

The Yemen oil rush: exploration heats up

By Judith Gurney

Until very recently, major oil companies considered Yemen as a lost cause. Its geology was judged inappropriate and topography was a forceful deterrent to exploration, given the Ruba-al-Khali desert, aptly called the Empty Quarter, on the east and rugged mountain ranges in the centre. In North Yemen, the religious imams who ruled until the early 1960s closed the borders to foreigners and locked the city doors at sunset; their overthrow led to a decade of civil war. Dry holes were the only result of occasional, fitful drilling in the Red Sea and adjacent coastal plains in South Yemen, a British Protectorate which became independent in 1967 after a bitter conflict.

The discovery of a sizeable oilfield in North Yemen in July 1984 by the Yemen Hunt Oil Company in the first well it drilled marked the beginning of the Yemeni 'oil rush'. Within three years North Yemen was exporting oil to world markets. Meanwhile, in South Yemen the Soviet firm Technoexport announced the discovery of oil in 1987. By early 1990 the *Oil & Gas Journal* was describing Yemen as 'one of the hottest exploration plays on the Arabian Peninsula' and Hunt Oil was given an 'A+' credit rating by Standard & Poor, largely as a result of its Yemeni oil operations.

Discovery of oil in North Yemen

In 1980 President Ali Abdullah Saleh ordered an aeromagnetic survey of North Yemen. A Syrian geophysicist, Moujib Al-Malazi, analysed the results and decided that an area near the ancient city of Ma'rib, where the temple of the Queen of Sheba lay in ruins, could be a sedimentary basin. He discussed his theory with Hunt Oil, a private company based in Dallas, Texas, unconnected in any way with the business interests of Herbert, Lamar and Bunker Hunt.

Hunt Oil's president, Ray Hunt, son of the Texas oilman HL Hunt's second marriage, presented a proposal to the Yemeni government for exploration in Ma'rib, a poor and sparsely populated region. A seismic survey was done which showed Cretaceous and Jurassic formations of the same age as those which produced hydrocarbons elsewhere in the Arabian Peninsula. In late 1981, Hunt negotiated a Production Sharing Agreement covering more than 12,600 square kilometres that allowed the newly formed Yemen Hunt Oil Company (YHOC) to explore in an area of the Ma'rib/Al-Jawf Basin, approximately 200 kilometres northeast of the capital, Sana'a. The agreement would dissolve after six years if the wells proved dry; if oil was found, there would be a 20-year development period plus an agreed five-year extension. Initial seismic work by YHOC, in conjunction with a Korean consortium led by Yukong Limited, mapped nine structures for drilling; the first three were named Alif, Lam, and Meem for mythical Arabic letters in the Quran.

The initial well in the Alif structure found 40° API crude at a depth of 5,000 to 6,000 feet, flowing at a combined rate of more than 7,800 b/d. Natural gas also flowed from several other perforated intervals at a combined rate of 55 mcf/d.

Development

Development of the Ma'rib/Al-Jawf Basin, which is about the same size as the Central Viking Graben in the North Sea, has been rapid, partly because wells, which do not require stimulation to produce, cost only about $800,000 to drill. In December 1985, YHOC formed a joint venture with Exxon, with Hunt holding 51 percent of the original concession in the newly formed Yemen Exploration and Production Company (YEPCO) and acting as operator.

Construction of a refinery was hampered by the underdevelopment of the North Yemen economy – in the 1960s, the story goes, there were only two automobiles in the capital city of Sana'a, and one of these had to be pulled around by a camel because the engine did not work. The Ma'rib refinery, with an initial capacity for processing 10,000 b/d of low-sulphur crude (0.08 percent sulphur), was finally completed on 12 April 1986. It was then planned to build a second refinery early in the 1990s.

The next requirement was a pipeline network which included, in addition to product lines to several cities, a 440-kilometre crude line over the mountain ranges to Ras Isa on the Red Sea. The initial capacity of this pipeline, which was completed in December 1987, was 225,000 b/d, with provision for expansion to 400,000 b/d by adding more pump stations. From Ras Isa, a further pipeline led to a 3-million barrel float-

ing storage vessel, the *Safer*, moored nine kilometres offshore, from which export tankers could off-load. *Safer*, formerly the supertanker *Esso-Japan* built in Japan in 1976, was named after the Safer salt domes in the Ma'rib Basin.

In October 1989, YEPCO signed an agreement for the construction of a LPG plant near Sana'a whose initial production capacity of 135,000 tons/year would more than cover Yemeni consumption of 120,000 tons/year. In the spring of 1990, Mannesman of West Germany was awarded a $28 million contract to construct this LPG plant.

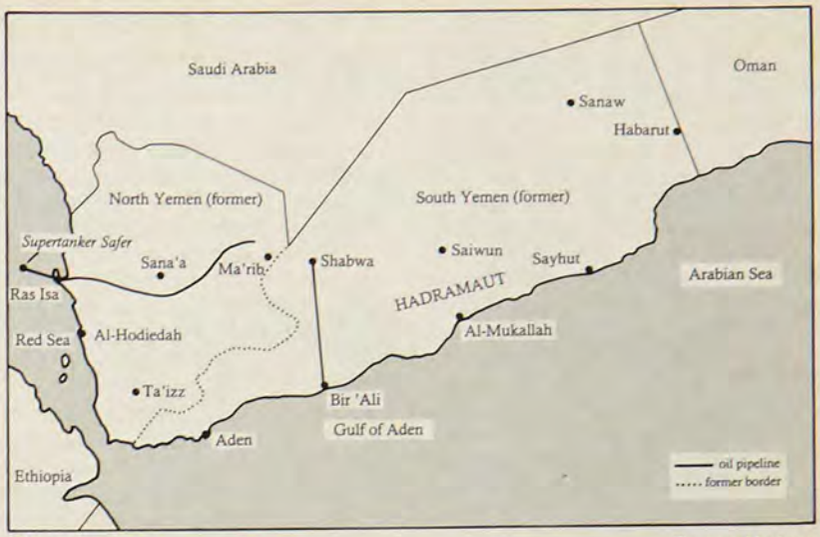
In the spring of 1990, North Yemen was producing an average of 180,000 b/d of crude, 150,000 b/d from the Alif field, 23,000 b/d from the Azal field, and the remaining 7,000 b/d, which included condensates, from nearby smaller fields – Sayf bin Dhi Yazin, Lukum, al-Thawri, and al-Wahdah. In the summer a larger field, As'ad al Kamil, some 15 kilometres northeast of Azal, came on stream with an initial production of 20,000–25,000 b/d which was expected to increase to 40,000–45,000 b/d within a year. Ma'rib Light crude was then selling FOB at a parity with dated Brent plus a surcharge of 10 c/b for US and 5 c/b for European destinations. Customers included Mobil (West Germany), Agip, BP, Pecten (US Shell), Amerada Hess and Sun Oil, who were then lifting about 85,000 b/d on annual contracts with quarterly price reviews. Proven oil reserves were estimated at 1,000 million barrels and associated and non-associated gas reserves were estimated at 7 trillion cubic feet, with the suggestion that this figure could rise to 20 tcf. To date, natural gas is being reinjected to maintain reservoir pressure and to store it for future use.

South Yemen oil

The Soviet firm Technoexport began exploration in South Yemen in 1983 in a 36,000 square kilometre area near Shabwa, east of Ma'rib, on a service contract basis. At the end of 1987 Technoexport confirmed the existence of commercial quantities of oil in three structures, 'Iyad West, 'Iyad East and Amal. Two types of crude were described, a 36° API with a 2.9 percent sulphur content, and a 43° API crude with a 0.02 percent sulphur content.

South Yemen had the advantage of an existing refinery at Little Aden. Originally built by BP in 1954, the Aden refinery, which was nationalised in 1977, had a processing capacity of about 161,500 b/d of crude and was running at about 50 percent capacity in the late 1980s. A pipeline, however, was needed to connect the Shabwa oil field with the refinery. In 1987 the Soviet firm Tyumen Pipeline Construction Association, financed by loans provided by the Soviet government, undertook to construct a 190-kilometre pipeline, with an initial throughput of 20,000 to 30,000 b/d, to Bir 'Ali on the Gulf of Aden coast, with a spur line to the Aden refinery. Until this pipeline was completed, production from the Shabwa field was trucked to the refinery at a rate of 5,000 to 7,000 b/d.

At the end of 1987 the South Yemen government announced oil reserves of 3,750 million barrels although it did not state whether these were proven or probable reserves. However, whereas development in North Yemen went apace, with production increasing 11 percent between 1988 and 1989, production in South Yemen stayed the same. Development of the Shabwa field was hampered by the Soviet firms' problems in obtaining foreign exchange from its cash-strapped government. At the beginning of 1990 the South Yemen government lost patience. Production had not increased since 1987 and the pipeline, which was supposed to have been completed by late 1989, was behind schedule. The government forced Technoexport to relinquish six Shabwa blocks which it was not working. The Sharjah-based Crescent Petroleum Company, Chevron and BP secured production-sharing agreements on five of these, and Technoexport was left to continue developing two proven structures.



Yemen

Sources: Various

Union of the two Yemens

On 22 May 1990 the Yemen Arab Republic (North Yemen) and People's Democratic Republic of Yemen (South Yemen) merged to become a new state, the Republic of Yemen, approximately the size of France with a population of about 12 million. At the time, North Yemen was producing 180,000 b/d of oil, with a domestic consumption of 45,000 b/d, and South Yemen was producing 5,000–7,000 b/d, with a domestic consumption of 15,000 b/d. The new Ministry of Oil and Mineral Resources, located in Sana'a but headed by the former South Yemen oil minister, quickly announced its decision to postpone the building of a new refinery in the north in favour of modernising the Aden refinery, including the addition of cracking capacity. A law was passed to permit foreign partners to obtain a share in the refinery in lieu of providing finance for the project.

The Oil Ministry also announced that exploration emphasis would be placed on the Shabwa area in the south and in the border area between the Ma'rib Basin and the Shabwa field. At the end of 1989 oil exploration rights to this 2,100 square kilometre border area had been awarded in a joint North-South Yemen agreement to a consortium consisting of YEPCO (37.5 percent), Kuwait's KUFPEC (25 percent), the Soviet firms Machinoexport and Zarughgeologia (18.75 percent) and CFP-Total (18.75 percent). A contract for seismic surveys was awarded in this border concession to France's Compagnie Générale de Géophysique early last year.

Exploration elsewhere is not being

neglected. YEPCO is continuing to develop the structures it controls and exploration is planned to start shortly in areas of the Ma'rib/Al-Jawf basin relinquished by YEPCO in agreement with the terms of the original Production Sharing Agreement. The first YEPCO relinquishment was awarded to the Canadian International Petroleum Corporation who subsequently assigned a 67 percent equity interest to Phillips Petroleum. Fifteen oil companies have recently submitted bids for the YEPCO second relinquishment. In addition, exploration is also underway by a consortium of Elf-Aquitaine, Lasmo and BP in the offshore/onshore Aden-Abayan area and by Occidental of Canada with the Lebanese-owned Consolidated Contractors in two onshore blocks in the al-Masilah al-Barriyah region in the east. Petro-Canada has signed a pact to explore near the eastern border with Oman, and a joint venture of the Bin Ham group of Abu Dhabi, Tullow Oil of Ireland, and Complex (Yemen) Ltd have a concession near the north-eastern border with Saudi Arabia.

Pressure to succeed

Yemen badly needs to develop its oil and gas reserves quickly in order to have exports to counter the nation's heavy dependence on imports, including food. The Gulf crisis has compounded this problem. Recently the government cancelled crude exports to its term customers because the loss of Iraqi and Kuwaiti crude supplies to the Aden refinery resulted in product shortages in Yemen itself. In addition, there is also a serious threat of reduced foreign remittances from Yemeni nationals working abroad, a critical element in the Yemeni balance of payments, following the Saudi government's cancellation of special concessions to the one million Yemenis working in Saudi Arabia.

Combining the resources of North and South Yemen will undoubtedly expedite the development of the oil sector. The new union, however, faces many threats to its effectiveness and permanence. There are real differences in ideology, as well as in domestic and foreign policy, between the two Yemens which, as recently as 1979, were engaged in open war. The north is dominated by tribal allegiances and religion; the south is a secular country ruled by a Marxist government for more than two decades. Economic conditions are of the nature to breed discontent: with a £360 per capita annual income, an illiteracy rate of 75 percent and the world's highest population growth rate. Moreover, Yemen's present membership of the UN Security Council has led to pressures not only from Arabian neighbours but from the major powers as well.

Given the amount of exploration currently underway, it seems highly likely that more oil and gas reserves will be discovered in Yemen, and that these can be developed relatively easily. How long the oil rush will last and if Yemen will become a significant player in international oil markets depends entirely on the amount of oil discovered in the next few years; the present proven reserves will not provide the country with a long-lasting bonanza. ■

Evaluating information support for energy industries

Throughout industry, people are finding that they have to adopt a more rigorous and cost-effective approach to managing information resources. The Institute of Petroleum's Information for Energy Group held a one-day conference in October on an evaluative approach to information support for the energy industries. Chairing the meeting, the IP's Jean Etherton said that there could be several ways to achieve an objective, and the decision on which to take was usually governed by available resources.

A major theme of the day was the value of information as a resource, a management tool and a profit centre. In his keynote address, Roger Bowes, the new Chief Executive of Aslib (The Association for Information Management) urged the importance of capturing the latent wealth of the information sector. A company can use its customers as one source of information, particularly about the extent of its corporate footprint, but data collection should be a continuous company activity. This can break down the cell structure of information units and integrate them to support intelligent decision-making.

Direct conversion of information into valuable intelligence through market research was explained later in the day by Peter Gorle of Metra Martech. He analysed some case studies in the energy industry, which invariably start with a review of published information, and then proceed through more expensive survey techniques to develop forecasts and options to follow.

The development of environmental data was reviewed by Struan Simpson of St James's Research. He outlined some national and international research programmes into environmental topics and emphasised that it was cheaper to obtain steady feedback from them than to do research only when it was needed. He concluded that sustainable economic growth offers investment opportunities to combine 'greenness' with profitability.

Many IFEG members are keen to hear about how other companies set up and manage in-house information services, particularly in oil companies, and about half the papers addressed aspects of this subject. Jackie Ireland of Shell International compared on-line energy information with traditional sources and showed a clear preference for the more modern techniques. On-line services have speed and currency; they are interactive and the results can be worked on to improve presentation. Costs in terms of equipment, support and training are generally hidden, but users of information rarely recognise that costs are entailed in any case. There is little retrospective information on-line but Shell does not need it. Another aspect of Shell International's information needs was described by Angela Kenny, who organises their records management. A mountain of paper is produced, much of it vital for business or legal requirements. In essence, the less frequently a document is likely to be required for future reference, the more obscure can be the place that it is archived.

Lindsay Parrish described the pros and cons of centralising a company's information systems in relation to Esso's experience. Centralisation appears to be a logical and economical solution but staff may squirrel away unreferenced material or copy files. Having made great savings in staff and equipment by total centralisation, Esso is now moving back to a degree of decentralisation.

Standards are a vital ingredient of any information resource. Consultant Diana Edmonds gave a practical analysis of recognised international standards and where you can get them. In addition to hard copy, it is now possible to get many standards on microfiche and some are included in on-line services. CD-ROM is a useful medium for storing large amounts of full text and some suppliers already offer standards in this format.

A more academic approach to setting up an information support unit was taken by David Ellis of the Department of Information Studies at the University of Sheffield. The needs of the unit can be determined by an information audit and its strategy derived by a technique known as infomapping.

A lighter side to information was described by journalist Philip Algar who looked at reporting of oil matters by the press and found that the industry had totally failed to put across the facts so that they were passed on correctly to the public. As well as some outrageous tabloid headlines linking petrol prices to our soldiers going out to the Gulf, his general examples of newspaper howlers were an effective antidote to post-prandial somnolence. The day closed with some advice from Andy Dawson of Taywood Engineering on how to protect your information unit at times when budgets were shrinking and the cost-cutters prowling. His suggestions on creative accounting might make an accountant's toes curl but his advice on offering additional services such as conferencing and slide preparation would be a sound way to help to protect an information unit from the hatchet.

A number of points were made during discussions. Staff may recognise that information is power, and therefore resist the integration of different information cells. It is also vital to train them to ask their questions efficiently, whether for an on-line or a manual search. The full proceedings of the Conference 'Information Support for the Energy Industries' will be published by the IP early next year.

Judith Mirzoeff
Hollobone Hibbert and Associates

Brazil – leader in deepwater technology

By George Hawrylyshyn, Brasil Energy

The old proverb, 'Necessity is the mother of invention' serves well to describe why Petrobras, the Brazilian national oil company, is a world leader in deep water technology.

Ever since the Brazilians made the first commercial oil strike in the South Atlantic 16 years ago, they've had to innovate and cut corners and experiment with new technology and methods of getting at the big crude reserves they kept on discovering in ever deeper waters. That historical strike in December 1974, was made at the Garoupa field in the Campos Basin, 100 kms off the coast and in a water depth of 120 metres.

Since then, Petrobras has discovered a total of 27 named fields in what is now called the Campos oil province, in waters that range from 80 to as deep as 1,615 metres producing more than 400,000 BOPD, about 60 percent of the country's total domestic production and one-third of its consumption. Campos crude reserves in waters up to 400 metres amount to 2.3 billion barrels, out of the country's total of 3.6 billion barrels, and in waters beyond the 400 metre mark, the reserves are estimated at almost 5 billion barrels, mostly in the deep water giant fields of Marlim and Albacora.

In the process the 100,000 square kilometre Campos Basin, which starts along the coast, north-east of Rio de Janeiro and reaches the depths of 3,400 metres going east in the direction of Africa has taken over from the North Sea as the world's foremost in-loco laboratory for testing new offshore technology. Following a series of world offshore records and pioneering use of equipment and methods of operation, Petrobras is recognized worldwide, from the British Energy Minister Colin Moynihan to Norwegian roughnecks, as the pace setter in offshore technology. Indeed Campos has redefined the definition of deep waters and is looked upon as a point of reference for the new water depth limits to which man can go in search of oil.

After a crash course from Gulf of Mexico and North Sea veterans, the Brazilian march into deep waters now can be compared to what the Americans and Soviets did in outer space three decades ago.

Now Petrobras is concentrating on another world offshore first: the subsea completion of the world's first Guidelineless (GLL) Christmas tree built especially for deep water diverless and guidelineless installation. The operation started in November and in terms of breaking technological and psychological barriers, it has been compared with the first landing on the moon.

Offshore first

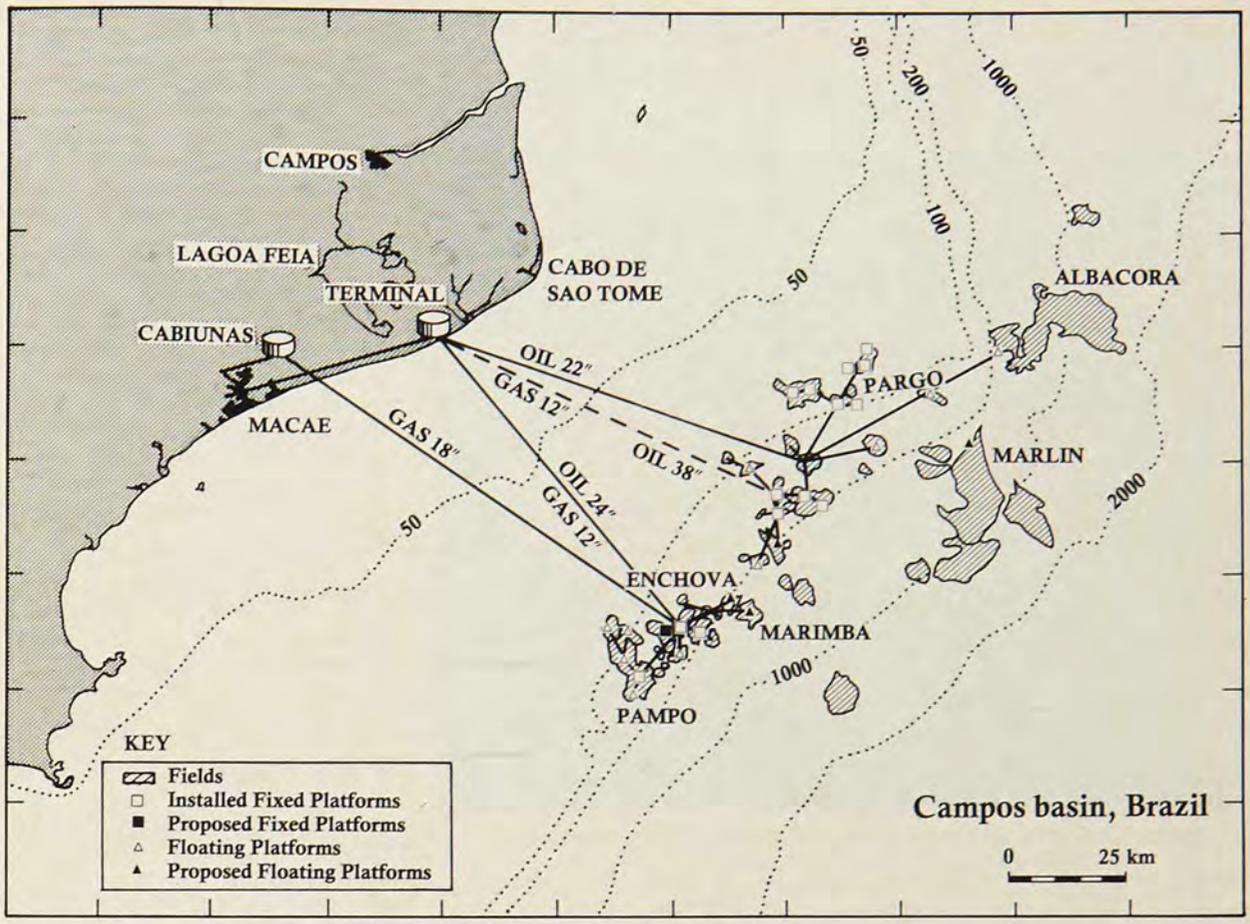
A successful installation and a troubleless and economic operation of the GLL wet tree at a depth of 720 metres (2,362 ft.) in the Marlim field, in Campos, will provide the confirmation for Petrobras's assertions that it has the technology and know-how to pump oil and gas from depths of up to 1,000 metres (3,281 ft.), and it is just a question of time and adaptation to go even deeper.

To put this technological feat into perspective, it should be noted that there are very few wells in the North Sea, Gulf of Mexico or elsewhere — except Campos — producing oil in waters beyond 300 metres (984 ft.). The world record has been held for more than two years by Petrobras where a Marimba field well has been onstream all that time, pumping oil from a depth of 492 metres (1,614 ft.). The Gulf of Mexico's Green Canyon, holds the sub-sea completion record at more than 600 metres (1,969 ft.), but those deep Placid wells reportedly never produced regularly and have been de-activated.

The GLL tree displayed at the Rio Oil Show is one of three already delivered to Petrobras by Rio de Janeiro Based CBV as part of a US$15 million Petrobras order for 10 such trees. It was designed by the Brazilian company and their American licensee, FMC, with the cooperation of Petrobras.

But Petrobras isn't breaking world offshore records for the fun of it. As one Campos veteran put: 'We've been finding ever greater volumes of oil in ever deeper Campos waters, leaving us no choice but to innovate and become pioneers in the field of deep water technology. This necessity to invent ways of getting at the deep reserves and do this on a low budget. From 1977 to 1986, Petrobras is reported to have invested only US$11 billion (B) in development projects, which resulted in an output of 350,000 BOPD during that time.

Without the astronomical funds the multinationals were spending in the North Sea and the Gulf, the Brazilians



had to make do with a fraction of those investments. They managed by taking a step-by-step approach cutting corners, de-bugging new methods and learning from their mistakes to arrive at today's position of world leadership.

Kindergarten stage

The first Petrobras experience in offshore production started way back in the late 50s in the offshore extensions of onshore fields in the state of Bahia. But, this project was practically on the beach and used conventional onshore technology from a rudimentary tower. In the late 60s, Petrobras took another step into the depths, this time in the Guaricema field in the Northeast, which used the early Gulf of Mexico technology and is considered the first offshore producer in Brazil, but still it is now looked upon as the kindergarten stage of the Brazilian offshore school.

It was in the Campos that the Brazilians really started their crash course. Initially even most of the rough-necks on the rigs were foreigners with American or European experience. The first of the 13 fixed production towers already installed in Campos were all built by foreign companies. All but one however, were built in Brazilian yards with local partners as apprentices. Until the mid-70s the Brazilan offshore industry was practically non-existent, but by emphasizing the transfer of technology the Brazilians learned fast and by 1989, the picture had reverted and Petrobras boasted that most of the people working on offshore rigs, even the ones chartered from abroad, were Brazilians and more than 90 percent of the content of their offshore development equipment was domestic. So much so that the Brazilian government decided that local industry had learned enough to be internationally competitive and had its protectionist policies removed, allowing wide-open international participation.

Petrobras started off on the wrong foot in Campos development. The project for bringing the Garoupa field oil onstream by means of a dry one-atmosphere tree was plagued by strikes and accidents and was abandoned in favour of wet trees.

Garoupa was upstaged by the field of Enchova as the first oil producer in Campos and the prototype of the Petrobras mastery of deep water technology. Enchova came onstream in 1977, only one year after its discovery and marked the start of a series of record breaking innovations.

Called at the time an Early (Production) Recovery System—ERS, and meant to be a provisional project for "long duration production tests" that would bring immediate profits from the oil produced, the Enchova system was the second of its kind in the world, after Argyll in the North Sea. Since then Petrobras has used 21 ERS or floating platform production systems (FPS) in Campos and right now has 11 in operation, thus surpassing, by far, the North Sea experience.

Enchova came onstream with a production of 10,000 BOPD, at a water depth of 116 metres (381 ft.) and it was indeed eventually replaced by a fixed tower but it served well to provide confidence for Petrobras to forge ahead into deeper waters. There the ERS became the Floating Production System—FPS—and first in marginal fields and later in deep and very deep fields it became accepted as an economically and technically viable permanent system.

Petrobras is continuing to innovate and improve on their FPS but basically

Semi-submersible installing wet trees in Albacora System. Courtesy: Petrobrás

it consists of a semi-submersible or converted tanker outfitted with processing facilities and control systems. Flexible risers, flow and control lines connect the floater to the sea floor, where template-manifolds collect the crude from wet Xmas trees. In a new FPS the oil is usually stored in tankers moored nearby and shipped ashore in others. The gas is initially flared but, in order not to waste the gas, Petrobras is now reinjecting it and also giving priority for the construction of gas pipelines.

Many of the FPSs now use both oil and gas flexible pipeline connections to the end of the three steel pipelines in Campos — the use of flexible tubing for this purpose is another Petrobras first.

Deep water anchoring and mooring systems and mono-buoys had to be adapted and tested. Much of this was done in the Albacora Field, Stage 1-A development, which is the only one that uses an oil tanker converted to a processing and control unit for a FPS and is the first producer in a giant field in Campos.

Deep fields

Another Petrobras innovation is the use of successful exploratory wells for development purposes, and this in turn resulted in the local development of a wellhead system which serves both purposes and provides considerable time and cost savings. As the depth of new systems increased and went beyond the 250 to 300 metre limit for divers, Petrobras had to resort to DL-GL (diverless, guide-lined) trees and eventually even those were surpassed so now the Brazilians are pioneering the GLL tree.

Based on the low cost, mobility (re-use), safety and short installation and therefore onstream time, Petrobras has felt the FPS is the best solution for deep water development. Petrobras claims that stormy weather notwithstanding, the down-time of Campos floaters is limited to 1 to 5 percent and has opted for the FPS over the Tension Leg Platform (TLP), semi-submersible towers fixed on the sea floor or other systems now being proposed for waters beyond the technical or economic depth of conventional fixed steel towers. Petrobras is putting up money to back up its choice and has just placed two orders with the Singapore yard, FELS, and their Brazilian partners Tenenge, for what is believed to be the world's first semi-submersibles built specifically for long duration, deep water floating production work.

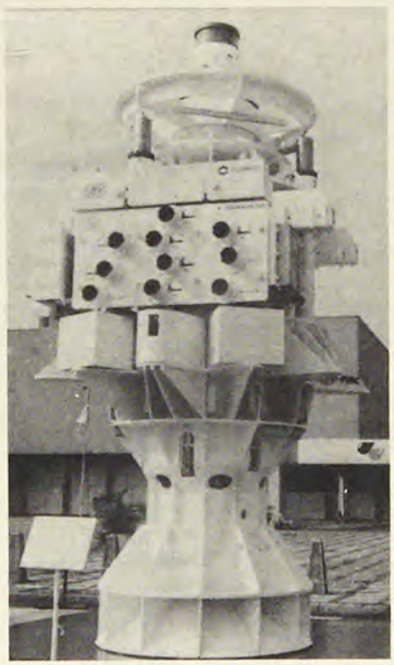
Marlim system

The orders amount to more than half a billion dollars and are the first of at least a dozen that Petrobras will need to have onstream before the turn of the century to raise domestic production to 1.5 million BOPD. Two other semis are now being converted in Brazil to serve as prototypes and test cases for the use of deep floaters, one of which is to service the Marlim Pre-Pilot Project, where the GLL tree will be installed.

Installation of the GLL tree in the Marlim Pre-Pilot System started last November and consists of the sub-sea completion of two wells, the 3-MRL-3, in 720 metres and the 4-RJS-413-D, in 575 metres **(map)**. By this month the system is to be onstream with 12 to 13,000 BOPD.

Francisco Massa, Petrobras co-ordinator of the Marlim field development project, said the sub-sea completion of the Marlim-3 well is to take approximately 45 days and will be carried out by a DP (dynamically positioning) drillship and the tree will be lowered by the drilling column and guided by sensors and ROVs. He said the project will require new investments of only US$ 10 million, as it will be using some of the equipment and services already accounted for in the $312 million cost of the Marlim Pilot Project.

The system will be serviced by the Petrobras XIII semi-submersible which was adapted for production at the Mendes Junior yard for $2.5 million. Massa pointed out that



World's first GLL deep water wet tree. Courtesy: Brasil Energy

another record to be set is that of anchoring a 250 ton, 15 metre diameter, 4.8 metre high, mono-buoy in 400 metres of water, which is almost double the previous world and Brazilian mark of 230 metres. The lowering of the flexible tubing and lines to such depths is another technological first.

Symbolically, the Pre-Pilot is a belt-tightening Petrobras innovation of the Marlim Pilot project, which called for ten sub-sea completions including the two wells that will be tapped now. It had originally been scheduled to come onstream next year at a rate of 50,000 BOPD, but because of cash-flow problems Petrobras postponed the start of this project three times and the latest onstream target date is 1992. But in order not to entirely postpone this first very deep water production system and the invaluable data it would provide as the most advanced "offshore laboratory"—not to mention the hard currency savings its oil production would provide by reducing crude import requirements—Petrobras opted to go ahead immediately with the much lower cost Pre-Pilot, significantly selecting one of the deepest wells in the original Pilot system.

Future plans

Looking towards the mid-90s, and the additional experience gained in the two Marlim pilots, Petrobras already has detailed plans drafted for the Marlim Phase-I and Albacora Phase-II major development projects, which will require investments of around $5 billion and are to produce around 400,000 BOPD from wells in water depths up to 980 metres.

Future Petrobras plans don't stop at the one kilometer water depth barrier. Because they have discoveries beyond that depth — the deepest is 1,615 metres — several additional potentially oil bearing deep water fields have been identified by 3-D seismology. Petrobras has already ordered an even deeper capacity GLL tree: for 1,800 metres. Designed by Brazil's Villares, in cooperation with their US licensee, Cameron Iron, and, again, the Petrobras R & D Center, that tree will soon be ready for laboratory tests, to be followed by sub-sea tests sometime this year. ■

Mysterious road tanker accident

A tanker travelling down the A38 dual carriageway near Kingsbury, Staffordshire, was recently involved in what at first appeared to be a mysterious accident. The 38-tonner, carrying 30,000 litres of gasoline, ran straight off the road to the nearside, crossed the grass verge and rolled sideways through 270° into a field about 30 feet below. With great good fortune, the driver was more shaken than seriously injured.

But what had been the cause of the accident? There was no evidence of poor road conditions, careless driving or excessive speed and workshop records showed the vehicle had been correctly maintained throughout its working life.

Physical examination of the truck revealed it to be in good mechanical condition for its age (excluding the severe accident damage) — with one exception. The main 3/8" bore metal air pipe which feeds air to the front spring brake chambers had a hole approximately ¼" diameter in it just inboard of the main nearside chassis member. The hole appeared to have been blown out by air pressure and not caused by external damage. Just above the area of the holed brake-pipe were the main electrical cables running from the battery master switch to the engine starter motor. These cables were badly corroded and had welded themselves together.

The braking system on this type of vehicle has a service brake operated by air pressure and an emergency/parking brake mechanically operated by a heavy duty spring located in the brake operating chambers. This design ensures that in the event of service brake failure a mechanical emergency brake can be applied.

The emergency spring brake relies on air pressure of approximately 85lb/in^2 to hold the brake in the off position; any loss of air pressure will apply the emergency brake with full application being achieved when air pressure is below 10lb/in^2.

Road tankers complying to the Dangerous Substances Regulations 1981 SI Number 1059 are built to a code of practice approved by the Health and Safety Executive. On the vehicle electrical system this involves the fitting of a battery master switch to isolate the vehicle's main electrical systems from the battery whilst potentially hazardous operations are carried out eg; loading the vehicle. From the master switch the main heavy duty battery cables run to the engine starter motor and on to the other electrical systems.

On some vehicles, these two main cables run through a hole in the chassis near the front wheel and on to the starter motor. Over a period of time the torsional movement of the engine in relation to the chassis had on the vehicle involved in the accident rubbed the two cables together and against the rubber grommet in the chassis through which they passed until the insulation had been worn away. The cables then electrically fused together. The heat this fusion generated was directed in the area of the two metal brake pipes supplying the near side front brake chamber. The heat build-up weakened these pipes and the air pressure contained in the emergency supply pipe burst the pipe, producing the hole described above.

From this point on, an accident was inevitable. Events over the next few moments would be:

1. The loss of air being close to the near side brake chamber would apply this brake first. The application would have been quite violent from the size of hole in the pipe. This heavy application of the nearside steered wheel brake caused the vehicle to veer to the left with the nearside wheel leaving the road and mounting the grass verge. The lack of traction at this point locked the wheel.
2. The driver tried to bring the vehicle back on to the road but by this time air pressure in the offside front spring brake chamber would be decaying through the damaged front pipe. The offside wheel also then locked up.
3. With both steered wheels not turning the driver could no longer steer the vehicle.
4. All control of the vehicle being lost, it continued off the road and overturned into the field.

As a result of this incident the following action has been taken by the vehicle's operator:

- All company road tankers were examined for failure of all heavy duty electrical cables, within 24 hours of the problem being found. No faults were found on models other than the type involved in the accident. On these models it is not possible to examine the cables where they run through the chassis without removing them from the starter motor. Examination showed several cables with insulation worn but intact. Any defects were rectified.
- In the light of these results, the vehicle manufacturer has been contacted, they have examined the vehicle and concede that a modification to the system is required. Their recommendations are awaited.
- Because of the serious nature of the fault, other dangerous substances carriers have been notified through the Institute of Petroleum's Technical Panel 'C' and the Health and Safety Executive.

The economics of sulphur in heavy fuel oil

By Trevor Morgan, Associate, Coopers & Lybrand Deloitte

The sulphur premium — the price differential between high and low sulphur fuel oil — has trended upwards in recent years as Western governments have imposed increasingly tighter limits on both the quality of fuel oil supplied and emissions of polluting gases from the burning of fuel oil*. This trend has had a significant impact on the relative prices of sweet and sour crudes and the economics of refining and power generation, in addition to the prices of natural gas index-linked partly to heavy fuel oil under long-term contracts. In this article, specially written for the *Petroleum Review*, Trevor Morgan analyses the economics of sulphur content in heavy fuel oil, the outlook for the sulphur premium in Western Europe and the broader implications for the oil and gas industries. He argues that, in spite of ever-tightening environmental controls, there is probably only relatively limited scope for a further rise in the sulphur premium over the coming years.

Historical trends

The sulphur premium has fluctuated enormously in recent years. Using monthly averages, the sulphur premium (CIF NWE) has fluctuated within a range of $5/tonne to $47/tonne over the period 1985 to first half 1990 (see **Figure 1**). In spite of the abrupt swings, caused by constantly shifting market conditions (partly seasonal in nature), it is possible to discern a rising underlying trend. Over the first half of 1990, the premium has averaged $24/tonne — up sharply on the previous year.

As a general rule, the sulphur premium has tended to be higher in the winter and lower in the summer, reflecting to a large extent the seasonal variation in the demand mix between industrial/bunker demand and power generation demand in addition to the reduced flexibility on the part of refiners to alter the high/low sulphur output split in the winter when refinery throughputs are at their highest. There is no apparent correlation between the level of oil prices generally and the absolute level of the sulphur premium; the price collapse in 1986 was not matched a corresponding slump in the price differential between high and low sulphur prices, while the recent hike in oil prices resulting from the Iraqi invasion of Kuwait has similarly not led to a significant widening of the sulphur premium.

*High sulphur fuel oil is defined as 3.5 percent sulphur or above (unless otherwise stated) and low sulphur fuel oil 1 percent sulphur or below.

Determining factors

The sulphur premium at any given time is determined by the ratio of low sulphur to high sulphur heavy fuel oil demand and the average sulphur content of the fuel oil produced in refineries.

a) Demand side factors:

The following factors determine the proportion of total fuel oil demand which is accounted for by low sulphur:

- Demand mix: the demand shares of the bunker, industrial and power generation sectors in total fuel oil demand. There are no restrictions at present (and will probably not be in the near future) on the quality of fuel oil burnt as bunker fuel, while the power generation sector (and to a lesser extent in Europe the industrial sector) is subject to controls on the quality of fuel oil burnt, either in the form of sulphur content limits or, to an increasing extent, through emission controls.
- Environmental legislation: In some European countries, only low sulphur fuel oil may be burnt in some or all uses. The sulphur content limit for all uses is 1 percent in Norway, Finland, Denmark and Luxembourg and 0.8 percent in Sweden; the limit in West Germany is 1.5 percent. Throughout Western Europe, low sulphur fuel oil is estimated to account for around 10 percent of the total fuel oil market. In addition, all European Community countries are now committed to reducing SOX emissions from large combustion plants (primarily power stations) in stages under the 1988 directive. A directive relating to emissions from small combustion plants is facing opposition due to difficulties in monitoring small plant emissions; if this directive fails to win acceptance it is likely that these emission reductions can be achieved by installation of flue-gas desulphurisation equipment (FGD), by burning lower sulphur fuel oil or by converting to natural gas, which emits virtually no SOX.
- Potential for fuel switching: A reduction in the use of high sulphur fuel oil may be accompanied by a switch to natural gas or gasoil rather than to low sulphur fuel oil, depending on relative fuel prices and the type of application.

b) Supply-side factors:

- Quality of crude oil input: other things being equal, the average sulphur content of the fuel oil stream will vary according to the sulphur content of the crude oil being refined. In reality, the 'sourness' of crude oils varies considerably: Middle East crudes are typically quite sour (ie, have a high sulphur content) averaging around 2 percent sulphur, whereas North Sea and North African crudes are typically, but not always, sweet (ie, have a low sulphur content).
- Refining flexibility: There typically exists a degree of flexibility in refining operations to adjust the output of the various refined product streams in response to changes in

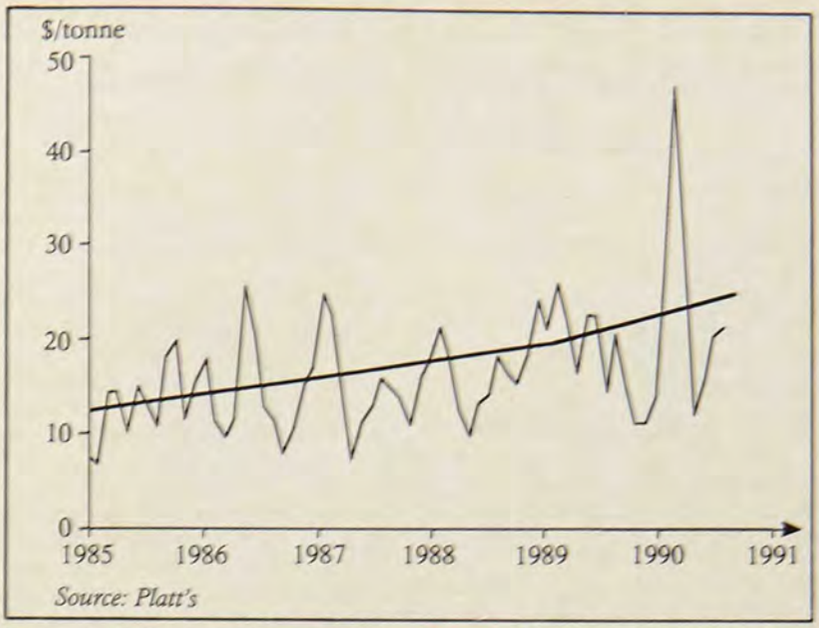


Figure 1: Differential between high and low sulphur heavy fuel oil prices

relative market prices. Although refineries vary enormously in terms of complexity and operational flexibility, it is typically possible for a refiner to boost the low sulphur fuel oil cut to some extent if justified by the economics of the refinery as a whole. In the longer term, there are a number of options open to a refiner to 'upgrade' the product streams, ie both reduce the quantity of low-value fuel oil in total and reduce the average sulphur content of the fuel oil stream. The most common processes are visbreaking, coking, hydrocracking and residue desulphurisation. All these processes involve to varying degrees both a reduction in sulphur content and conversion of part of the fuel oil input into lighter products. There is also some flexibility for refiners to blend different fuel oil streams to increase the availability of fuel oil with less than 1 percent sulphur content.

The two principal means by which sulphur can be removed from fuel oil — at the production stage (residue desulphurisation) and at the point of consumption (FGD) — can influence both the supply and demand for low sulphur fuel oil relative to high sulphur fuel oil and therefore impact on the sulphur premium. In short, if the sulphur premium exceeds the cost of sulphur removal, there would be an incentive for either refiners or consumers of high sulphur fuel oil to invest in the required facilities. This would have the effect of either boosting low sulphur fuel oil supply or switching demand to high sulphur (where FGD is fitted), thereby putting downward pressure on the sulphur premium. We consider below the costs of sulphur removal, which should in the long-term represent an upper limit for the sulphur premium.

Costs of residue desulphurisation

The most effective refining process for reducing the sulphur content of the straight-run fuel oil stream (ie, the output from the initial atmospheric distillation process) is residue desulphurisation. The costs involved depend on a number of factors:

- discount rate and length of depreciation period used for capital costs
- energy costs (these amount to around 6 percent of the residue input, which is effectively lost in the process)
- selling price of the sulphur produced (offsetting capital and operating costs)
- market price of the gasoil produced (depends on quality and market conditions)

The cost of residue desulphurisation is extremely sensitive to the discount rate and the level of gasoil prices assumed. Actual costs can vary enormously depending on the specific circumstances of any given refinery. Our indicative estimate of the current cost of reducing the sulphur content of fuel oil from 3.5 percent to 1 percent in Western Europe is of the order of $35–40/tonne of fuel oil. Of this, some 70–90 percent are accounted for by capital costs.

Costs of flue-gas desulphurisation

Flue-gas desulphurisation represents an indirect way of removing sulphur. FGD costs, like residue desulphurisation, vary enormously according to the size of the combustion plant, whether it is retro-fitted or in new plant, operating load factor and the discount rate. An indicative estimate of the cost of retro-fitting FGD in Western Europe in oil-fired power stations would be of the order of $25–30/tonne of fuel oil input. The cost of FGD is highly sensitive to the load factor; many oil-fired stations are generally positioned low down in the merit order, such that FGD costs may be well above $30/tonne. Up to now, there have been no instances of FGD installation at oil-fired power stations, which is not surprising in view of the fact that the sulphur premium has generally been well below the cost of FGD installation.

The cost of retro-fitting FGD in refineries (which account for an estimated 8 percent of SOX emissions in Western Europe) is thought to be considerably higher — in the order of $75–100/tonne of fuel oil used as refinery fuel. As a result, the installation of FGD in refineries is unlikely to be an economic alternative to switching to low sulphur fuel oil or natural gas as refining fuels in most cases. The costs of retro-fitting FGD in smaller industrial boilers and furnaces are estimated to be at least as high.

Sulphur premium outlook

The outlook for the sulphur premium in Europe (which will probably not deviate greatly from that of other regional markets given the openness of international oil trade) will depend on the interplay of all the above factors. It is important to note that the sulphur premium is not directly dependent on the level of real oil prices. Overall, there is likely to be a continued shift in demand towards low sulphur fuel oil in the refining, industrial and power generation sectors, mainly prompted by progressively tighter environmental restrictions on the burning of high sulphur fuel oil, although this will to some extent be offset by steady growth in demand for high sulphur fuel oil in the bunker market (see **Figure 2**). In total, low sulphur fuel oil demand is expected to rise from around 12 million tonnes at present to around 30 million tonnes by the year 2000; high sulphur fuel oil demand is projected to drop from around 100 million tonnes to about 60 million tonnes over the same period.

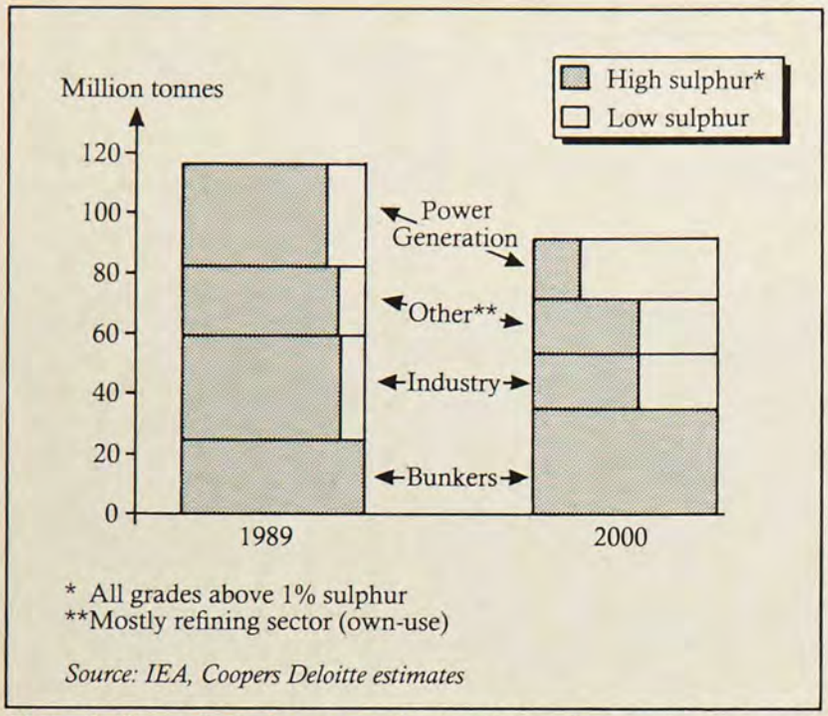


Figure 2: Heavy fuel oil consumption in Western Europe by sector and sulphur content

The biggest switch-over to low sulphur fuel oil will be in Italy. In order to meet lower SOX emission targets, state-owned electricity utility, ENEL (which consumes some 20 million tonnes per year of fuel oil — around 20 percent of total Western European demand), is already switching from burning predominately high sulphur fuel oil to low sulphur. This explains to some extent the dramatic rise in the sulphur premium at the start of this year. This phase-out is expected to continue over the coming years, such that virtually all fuel oil used in power generation will eventually be low sulphur. By the early part of next century, it is likely that the burning of high sulphur fuel oil throughout Western Europe will be confined to the bunker market and to those power stations where FGD has been fitted. Low sulphur fuel oil use will become increasingly concentrated in power generation in plants where FGD has not been fitted.

The fuel oil market as a whole is likely to contract by the end of this decade. Where there is switching from high sulphur fuel oil in power generation and industry, the alternative is in many cases likely to be natural gas (in power generation and industry) or gasoil (mostly in industry). Even if the sulphur premium were to rise to a level that would make FGD retro-fitting economic, it is likely that the end-user, whether it be a power station or an industrial unit, would in many cases prefer to convert the plant to burn natural gas rather than fit FGD equipment, particularly in view of fears over the future trend in fuel oil prices.

On the supply side, crude oil quality problems may mean that refiners are unable to significantly boost the proportion of low sulphur fuel oil in total fuel oil output, particularly over the next few years given the limited amount of investment over the last few years in new fuel oil upgrading capacity. The actual volume of low sulphur fuel oil available may, however, rise in the short-medium term due to generally higher throughputs in Western European refineries. This is also likely to be supplemented by fuel oil imports from South America, North Africa and the Middle East. By the latter half of the 1990s, new investments in refinery upgrading will probably result in a fall in the total volume of fuel oil produced, while at the same time boosting the output of low sulphur fuel within that total.

On balance, it is likely that supply of low sulphur fuel oil from European refiners in addition to imports will be sufficient to meet a steady increase in demand at an average sulphur premium of around $25–30/tonne through to the end of the century. Thus, in our view, the sulphur premium is likely to remain a little above the average level of the first half of 1990 and substantially higher than the level of recent years, but a further sharp increase is not expected. Seasonal fluctuations are, of course, likely to drive the sulphur premium well outside this range at times. Lack of refining flexibility and a continuing switch-over from high to low sulphur fuel oil in power generation, particularly in Italy, may lead to a higher sulphur premium in the near term (perhaps over the next two to three years), but this upwards pressure on the sulphur premium is likely to diminish by the late 1990s as new refinery upgrading units are brought on stream.

The long-term ceiling for the sulphur premium is likely to be reached at around $30–35/tonne at current prices, given that the installation of FGD in high load factor oil-fired power stations (mainly in Italy) would become economic at that level of sulphur premium. In that case, fuel oil demand would shift from low sulphur to high sulphur, thereby limiting the upwards pressure on the sulphur premium. Direct residue desulphurisation is, thus, not expected to become economically viable in Western Europe to any significant extent, at least not before the end of the century.

Broader implications

The difference in the market price between high and low sulphur fuel oil has a significant and broad-ranging impact on the oil and gas industry. The main implications of a stable to rising trend in the sulphur premium are likely to be:

- Notwithstanding the upheavals caused by the Gulf crisis, absolute sweet/sour crude price differentials are unlikely to widen greatly beyond current ranges in real terms. If crude prices continue to rise in real terms, specific gravity will become a more important consideration to refiners looking to maximise the yields of light-end products.
- There will continue to be strong incentives for refiners to boost upgrading facilities, both in terms of raising the yield of higher value light products and reducing the sulphur content of the heavy fuel oil output stream.
- Beyond the implications for the oil industry, the trend in the sulphur premium may also be relevant to long-term contracts where heavy fuel oil is used in indexation formulae. If there is limited scope for a further rise in the absolute level of the sulphur premium, a general rise in oil prices may cause the high sulphur fuel oil price to rise proportionately faster than the low sulphur price. Depending on the way base prices and indexation are negotiated, this conclusion might suggest a change in the traditionally preferred mix of price escalators. ■

Standardization News

Measurement of the hydrogen sulphide content of fuel oil

Following a request from UKPIA, the ST-G-5C sub-panel has produced a method for the determination of hydrogen sulphide in the liquid phase of fuel oils covering the range from 0.1 mg kg^{-1} to 20.0 mg kg^{-1}.

The method 'Hydrogen Sulphide Content of Fuel Oil' has been designated Proposed Method BJ and will be published in the 1991 IP Standard Methods for Analysis and Testing of Petroleum and Related Products.

The principle of the method is as follows:

The hydrogen sulphide is stripped from a known mass of the fuel oil, with oxygen-free nitrogen, into an alkaline suspension of cadmium hydroxide. The collected sulphide is subsequently determined by spectrophotometric measurement of the methylene blue produced from its reaction with a strongly acidic solution of N,N-dimethyl-1,3-phenylenediamine dihydrochloride and ferric chloride.

The method requires that duplicate determinations are performed and specifies sample containers and handling procedures to minimise losses of hydrogen sulphide by oxidation and adsorption.

The precision of the method has not yet been established but a round robin.

The immediate need for a method having been identified, on safety grounds, it has been decided that it shall be made available before publication of the 1991 Test Method Book, and copies are available from the IP library at a cost to members of £5.

The aim of this prior publication is twofold, firstly to provide a reference point for specification writing to this method and secondly to solicit users' comments. Such comments should be forwarded to the Technical Officer (Standardization) at the IP.

Committee and Panel Chairman changes

There have been a number of changes recently brought about by the retirement or the standing down of chairmen of some of the committees and panels making up the Standardization Section of the IP.

Standardization Committee ST
Chairman Mike Hurcombe replaces Geoff Crump
Deputy Chairman Tim Berryman

Lubricants and Waxes Sub-committee ST-C
Chairman Mike Smart replaces Walter Winning

Analysis Sub-committee ST-G
Chairman Roger Amos replaces Mike Hurcombe
Deputy Chairman Bob Hooks

Engine Tests of Motor and Aviation Fuels Panel STB-1
This panel is now split into two sections:
Gasoline and LPG Fuels STB-1A
Chairman Ieuan Davies
Diesel Fuels STB-1B
Chairman Martin Openshaw
These panels will continue the work previously carried out by STB-1 which was chaired by Lionel Simmons

Volatility Panel STB-9
Chairman Bob Hooks replaces Peter Richards

Organic Analysis Panel STG-2
Chairman Albert Lynes replaces Roger Amos

Grease General Test Panel STD-1
Chairman Ron Clarke has retired and a replacement will be announced.

Grease Mechanical Test Panel STD-3
Chairman Bill Crump has retired and a replacement will be announced.

The IP would like to take this opportunity of thanking all the retiring chairmen for their sterling services and wishing their successors all the best for the future.

IP 113/53 Flash Point (Closed) of Cutback Bitumen

The Bitumen General Test Panel ST E-2 have proposed that the above method should be withdrawn.

A notice will be placed in the 1991 IP Test Methods Book and the method withdrawn in 1993 unless a case is made for its retention.

Objections to this proposal should be sent to John Phipps at the IP.

The rise and fall of bunker prices

By Mark Scruton

Since the Iraqis invaded Kuwait, oil prices have risen dramatically. As the price of crude yoyoed up and down — Brent crude topped $40 per barrel at the end of September before settling down around the $30 mark in mid-November — some consumers of oil products have been more affected than others.

According to Mr Neil Cockett, an independent marine and oil consultant, one of the consumers worst hit has been the beleaguered shipowner.

But despite the immediate problems Mr Cockett holds out some hope for shipowners in the long run because he believes the shut-down of the Kuwaiti oil refineries could cause an increase in the worldwide production of residual fuel oil.

Talking about the effect of the Gulf crisis on shipowners, he said: 'Obviously oil companies may not agree with this. It is true they have had many headaches in switching their sources of supply of crude, as well as programming manufacture of oil products from their refineries. But not much is being said about the operators of ships and little help is being offered them.'

'Bunkers are the largest single operating cost for the owner or charterer, as we all know. The oil companies are quick to pass its extra costs onto the customer. This has been seen only too markedly in the few months since Iraq fell on Kuwait. Bunker prices soared by almost 50 percent within the first eight days of the crisis though of course neither the fuel laid-down cost or its plentiful supply had changed at all.'

Price rises

Because of the immediate rise, by 10 August the Bunker Price Index peaked to a first high of 880 from a 31 July index price of 599, before falling to 828.

On 24 August the index jumped to 972 before retreating to 903 a week later. By 15 October the index had jumped again breaking the 1,000 index benchmark at 1,093 before drifting slowly downwards, ending up at 1,060 in mid-November.

Mr Cockett questioned whether this index price hike was justified. 'For the vast majority of available bunker fuels the supply economics can hardly have changed since 31 July when the index was almost half its present value.'

But he added: 'Of course, it is natural that sentiment and lack of confidence, based on rumour and fear, should enter the economic equation. The greatest fear for the oil market being the possibility of all-out war and the chance that the important Saudi oil fields might be damaged or isolated for a time.'

Mr Cockett said it is because of these fears that bunker prices are being talked up, like the gasoline prices in the United Kingdom and other OECD countries.

He added it is also probably why the International Energy Agency (IEA) — set up to build up petroleum stocks because of earlier oil crises — has refused, so far, to release some of its 90–100 days of supplies onto the market.

'It is clear that the oil market will remain very jumpy while the political situation in the Middle East is uncertain. It is probable that bunker price levels will tend to rise by inordinant amounts,' he said.

Possible scenarios

Looking at the possible scenarios Mr Cockett said, firstly: 'That if Iraq backed down, the market will fall back to its end of July position and resume its previous steady rise into the future.' Secondly: 'A protracted stalemate produced by a successful UN embargo of Iraq on the other hand will bring a sharp rise in oil prices until the world oil industry is able to sort itself out and replace the shut-off Iraq/Kuwait crude oils, then price levels will sink back and rejoin those of the above first scenario,' he said.

'The prospect of a major conflict or backdown by the UN does not bear thinking about . . .'

'The prospect of a major conflict or a back-down by the UN does not bear thinking about in this context,' he added.

'Assuming therefore one or other of the first two alternatives, it is evident that bunker prices will remain high. It is likely also that freight markets will not improve much, so making it difficult for the shipowner, unlike the oil company, to pass these extra costs on.'

Fortunately things may not be so bad for the bunker buyer as these

scenarios suggest. There is an imbalance between the location of relatively unsophisticated oil refineries outside Iraq and Kuwait and the oil product requirements of the consuming countries they serve.

'In other words the loss of gasoline, naphtha, kerosene and gasoil — the top end of the barrel/white products — from the sophisticated Kuwaiti refineries, plus the large needs of the growing war machine in Saudi Arabia for just these products will create a shortage of them, particularly in the Far East,' he said. There, the refineries are mostly first generation types not geared to maximise white products.

White products

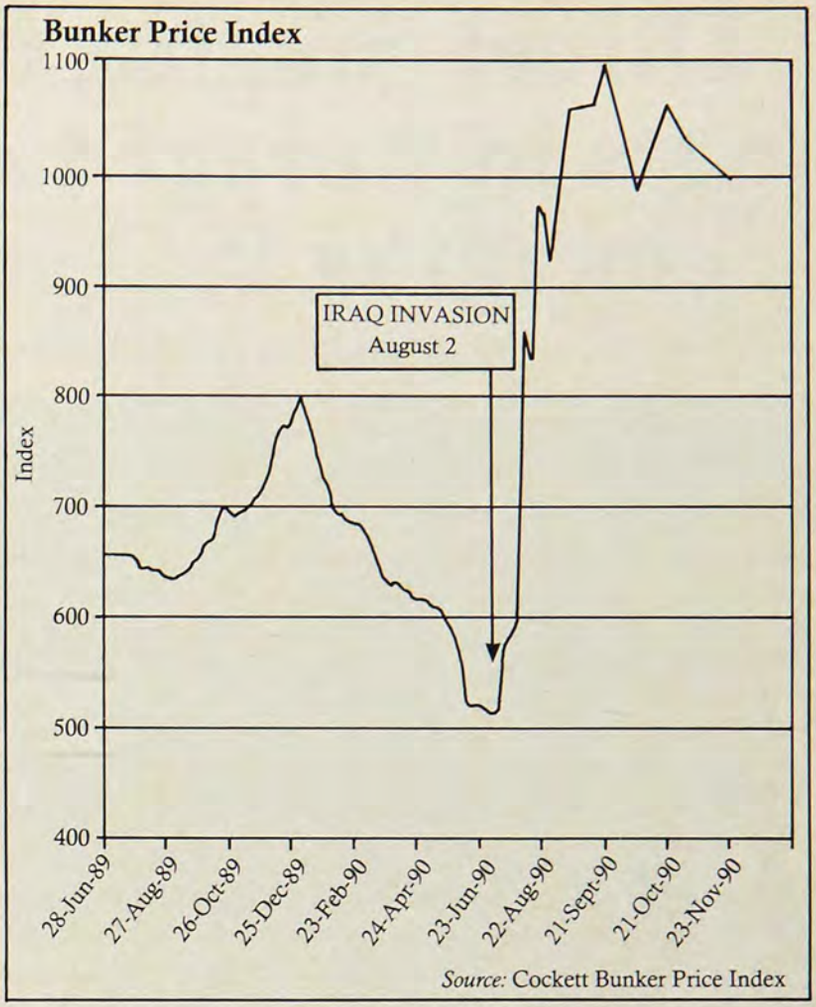
'Therefore, in order to manufacture them and make up for the lost white oil imports from Kuwait and other Gulf countries, more refining capacity in the Far East will be put into action so producing excess quantities of residual fuel oil.'

'The result will tend to show a weakening in marine bunker fuel oil prices in relation to other oil products such as gasoline and gasoil — not so good for marine gas oil and marine diesel oil users. Already this is evident in the way prices across the barrel are developing and shipowners may take some consolation from this,' he said.

Mr Cockett gave a few tips for the shipowner and charterer to weather the present price-hike storm.

- There are several ways to hedge bunker costs forward.
- There are experienced and professional bunker brokers in the market who can help the bunker buyer find good quality and cheap fuels as well as advise on the timing of the stem.

'This last point is most important when prices are jumping overnight by tens of dollars. The oil supplier is unlikely to say to the owner that fuel oil is about to drop $20. The expression 'Don't bunker around' rather proves the point,' he said. ■



Source: Cockett Bunker Price Index

Petroleum Review acknowledges the assistance of Mr Cockett, who lectures at the College of Petroleum Studies, in preparing this article.

Exploration and Production Discussion Group

The next meeting of the E and P Discussion Group will be held at the Institute of Petroleum on **Thursday, 17 January 1991** starting at 5.30 pm. (Tea and biscuits will be available from 5.00 pm).

Natural Gas Production for a Mixed Market-place

Speakers: Mr LC Soileau, Director Southern Region, and a colleague, Arco British Ltd.

If you would like to attend this meeting please contact **Mr AE Lodge,** Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR **Tel: (071) 636 1004 ext. 236.**

Direct gauging of liquid mass in storage tanks – the emerging ISO standard

By Milos J Machacek, Foxboro GB Ltd.

Even though the hydrostatic measurement principles are not new, accurate measurements of liquid mass by the hydrostatic method have only been enabled by relatively recent advances in pressure sensing technology.

Pressure sensors with accuracies in the order of 0.02 percent of the sensor range are now available. This allows direct liquid mass measurements whose accuracy is limited more by accuracies of the tank calibration tables than by the sensors themselves.

Given the measurement accuracies comparable with the existing level gauges, the Hydrostatic Tank Gauges (HTGs) have several other attractions over the traditional measurement techniques:

- the mass of tank contents is measured directly, with no need to do any manual sampling for determination of quality parameters, such as density.
- the mass measurement is not influenced by thermal expansion of the liquid or its stratification.
- the primary sensors are mounted near the bottom and on the outside of the tank, where their positions are relatively stable and maintenance access is easy.
- the gauges have no moving parts with consequent high reliability.

Even though HTG is primarily a mass measuring gauge, it can also measure density and calculate observed and standard liquid volumes as well as liquid levels. The accuracy of these volume and density measurements are currently being considered by ISO/TC 28/SC3/WG4.

HTG performance is best on vertical tanks where the tank cross-sectional area is practically constant. Very good performance can also be achieved on other types of tanks, e.g. spheres and horizontal cylinders.

Foxboro, together with certain oil companies, have pioneered the development of HTG. It was mainly due to the quality of the field performance of these gauges that ISO took an interest in the method. ISO then initiated the process that has led to the drafting of the new standard.

Hydrostatic measurement of mass of liquids

Hydrostatic Tank Gauging is a method for the direct determination of total static mass of liquids in vertical storage tanks. The gauges use high precision, stable, pressure sensors mounted at specific locations on the tank shell.

Total static mass is directly derived from the measured pressures and the tank capacity table. Other variables, such as level, observed and, standard volumes and observed and reference densities are also calculated from the product characteristics using the established conversion and calculation procedures.

Figure 1 shows the typical set-up of the HTG on a storage tank. Sensor P2 is required for density measurements; it can be omitted if the liquid density is known. Sensor P3 is only required if the tank is not vented to atmosphere, e.g. with an inert gas blanket.

Figures 2 and 3 show the parameters for calculations and the variables calculated by the HTG processor.

Figures 4 and 5 show the sequence of calculations performed by the HTG processor.

ISO

The International Organisation for Standardisation (ISO) is a worldwide federation of national standards bodies whose task is to prepare and publish International Standards. International organisations, governmental or non-governmental, in liaison with ISO, also take part in the work.

ISO procedures

Committee Drafts are normally prepared by Working Groups of experts, delegated for the work by those ISO member bodies which

decide to participate actively in preparing the standard. Once the Committee Draft is adopted by the Working Group, it is circulated by the Technical Committee secretariat to all ISO member bodies which have expressed active or passive interest in the subject of the standard.

Following resolution of the ensuing comments by the Working Group, the Committee Draft is submitted to the Technical Committee for adoption as the Draft International Standard. Draft International Standards adopted by the Technical Committees are circulated to the ISO member bodies for approval before their acceptance as International Standards by the ISO council. They are approved in accordance with ISO procedures requiring a ⅔ majority of participating members who vote and not more than ¼ total votes against.

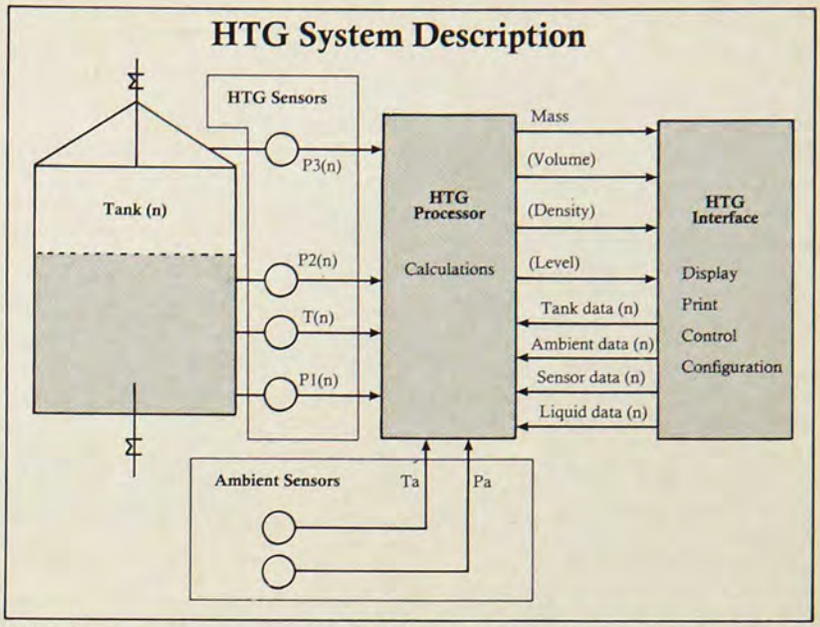


Figure 1 **Brackets denote parameters to be included in Part 2**

Direct static mass measurement

The ISO organisational hierarchy is as follows:

- Technical Committee (TC) 28 = petroleum products and lubricants.
- Sub-committee (SC) 3 = static measurements.
- Working Group (WG) 4 = direct static mass measurements.

Working Group 4 of the Sub-committee 3 of the Technical Committee 28, was set up following the meeting of ISO/TC 28/SC 3 in 1985 in Rome.

The following organisations became active members of WG4 and remained in the group until the successful conclusion of the work on the present Committee Draft.

Tank gauging equipment manufacturers:

- Foxboro (UK) – document editor
- Rosemount (Netherlands)
- Texas Instruments (France)
- Enraf (Netherlands)

Tank gauging equipment users:

- PAZ Oil (Israel) – working group chair
- Esso (UK/Belgium) – document editor
- Exxon (USA) – document editor
- AGIP (Italy)
- Elf (France)
- Trapil (France)
- SNAM (Italy)

Government agencies:

- NMI/IJkwezen (Netherlands)
- SIM (France)
- BSI (UK) – SC 3 secretariat

The ISO Working Group 4 was liaising with a working group in the International Organisation for Legal Metrology which was at the same time drafting a standard for legal direct static mass measurements.

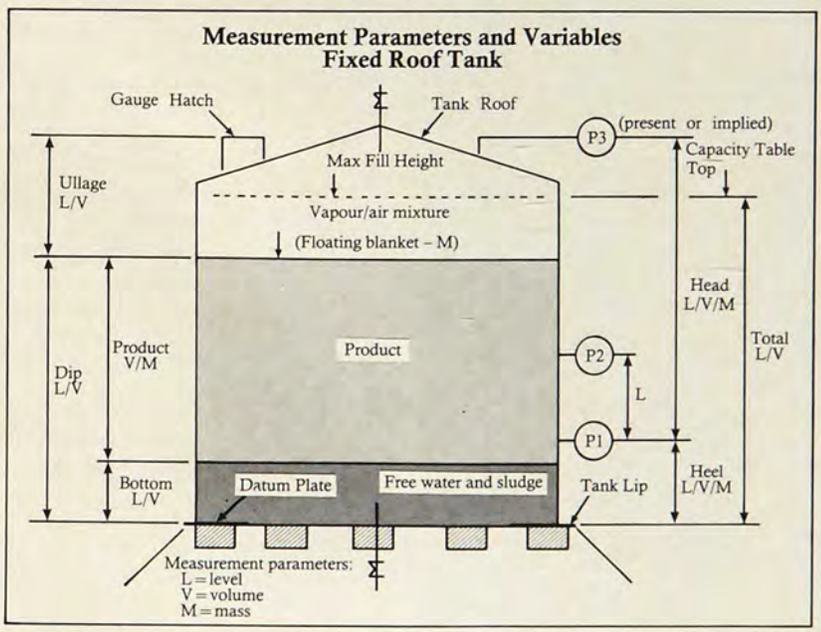


Figure 2

Field trials

The first mandate of WG4 was to investigate whether or not the hydrostatic head measurement technology provided adequate performance to justify writing a standard for direct static mass measurements of the petroleum liquids.

The early stages of the WG 4 work were dedicated to organising and monitoring field trials in which the hydrostatic method was compared with other recognised methods of mass, volume, level and density measurements.

During two years of the Working Group activity, field trial results have been collected and analysed (see **Table 1**).

All trials produced consistently good results for: mass inventory and transfer measurements.

Sufficient evidence was obtained to continue work on standard volume inventory and transfer measurements and density measurements.

In general, the HTG performance equalled the results obtained from the existing static tank gauges, automatic or manual. In most cases, the HTG measurements were more consistent

than those obtained with the existing tank gauges.

Committee Draft

Following the success of the field trials, the chairman of WG 4 reported to its parent committee (TC 28) that the technology was ready for a standard and proposed to carry out the work.

At the TC 28 meeting in Berlin in 1987, WG 4 was given a mandate to write a standard for static mass and another for standard volume measurements on vertical cylindrical tanks with fixed roofs or floating roofs with constant roof load, using HTG.

WG 4 work history

Since it was established, WG 4 met regularly with an average period of approximately six months.

Between the meetings, subgroups as well as individuals were assigned tasks such as collecting and analysing the field trial results and editing the Committee Draft document.

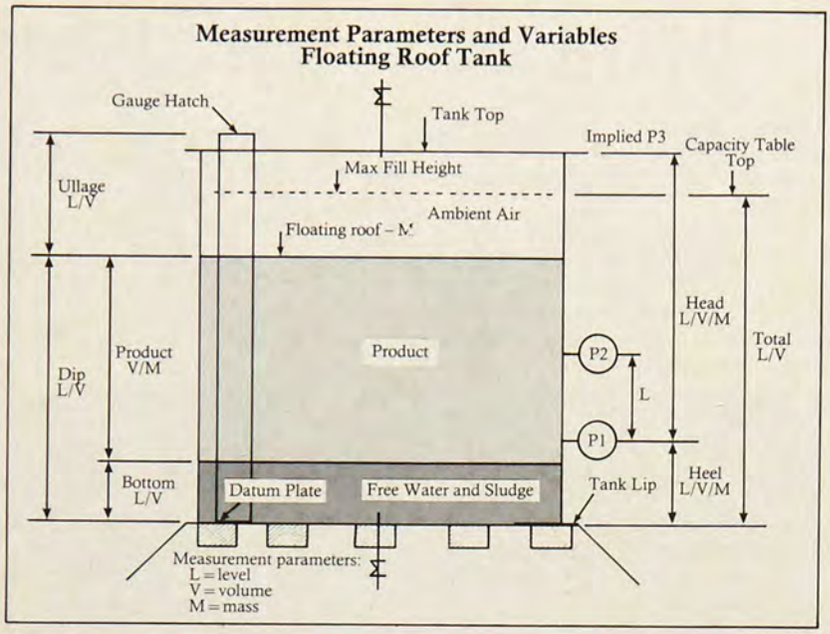


Figure 3

Location	*HTG System*	*Comparison with*	*Tests performed*
AGIP, Rome, Italy	*Foxboro*	Manual gauges (level, density, temperature), automatic level gauge, buoyancy gauge, volume flow meter, weighbridge	*Mass and volume, inventory stability and accuracy, transfer accuracy*
Shell, Stanlow, UK	*Foxboro*	Hydrometer lab densitometer	*Density accuracy*
Esso, Port Jerome, France	*Foxboro*	Manual gauges (level, density, temperature), automatic level gauge, volume flowmeter with densitometer	*Mass and volume, inventory stability and accuracy, transfer accuracy*
Statoil, Kalundborg, Denmark	*Foxboro*	Manual gauges (level, density, temperature), automatic level gauge, volume flowmeter with densitometer, weighbridge	*Mass and volume, inventory stability and accuracy, transfer accuracy*
Nieuwe Matex, Rotterdam, Netherlands	*Foxboro*	Manual gauges (level, density, temperature), automatic level gauge, volume flowmeter, densitometer, weighbridge	*Mass and volume, inventory stability and accuracy, transfer accuracy, density accuracy, effect of wind*
Elf, Donges, France	*TI*	Manual gauges (level, density, temperature), automatic level gauge, densitometer	*Volume inventory accuracy, density accuracy*
BP, Hythe, UK	*Foxboro*	Weighbridge	*Transfer accuracy, inventory stability*
Shell, Haydock, UK	*Foxboro*	Buoyancy gauge	*Mass inventory, mass transfers*

Table 1

Several versions of the draft document for direct mass measurement were produced and debated in the working group before the final text of the draft was agreed at the meeting in November 1989.

The draft was then passed on to the secretary or TC 28, SC 3 for final text editing to satisfy the ISO drafting rules. The Committee Draft is now being circulated to ISO member bodies for comments.

As previously mentioned, the HTG standardization will be issued in two parts:

- Part 1: Mass measurements by Hydrostatic Tank Gauging
- Part 2: Volume measurements by Hydrostatic Tank Gauging.

Part 1 has already been written, while Part 2 is still being considered by WG 4.

Part 1 – Mass Measurements

Part 1 of the Committee Draft gives guidance for the installation, commissioning, monitoring and calibration of HTG for the direct measurement of static product mass in petroleum storage tanks.

It deals with HTG which use pressure sensors with one port open to the atmosphere (gauge sensors or differential pressure sensors used as gauge sensors).

It is applicable to the use of HTG on vertical, cylindrical, atmospheric storage tanks with either fixed roofs or with floating roofs whose roof-load is fixed.

It is applicable to direct measurements of gross mass of any petroleum product, including heavy oils and bitumens. It allows calculations of net product mass by subtraction of independently measured mass of water and sediment in the tank and (if applicable) of the constant mass of the floating roof.

It is not intended to cover the use of HTG on high pressure tanks such as LPG spheres or bullets. This may be considered in the future.

Part 2 – Volume Measurements

Part 2 of the Committee Draft will give guidance on the installation, calibration and use of HTG for the direct measurement of static volume in petroleum storage tanks. It is still in course of preparations in WG 4.

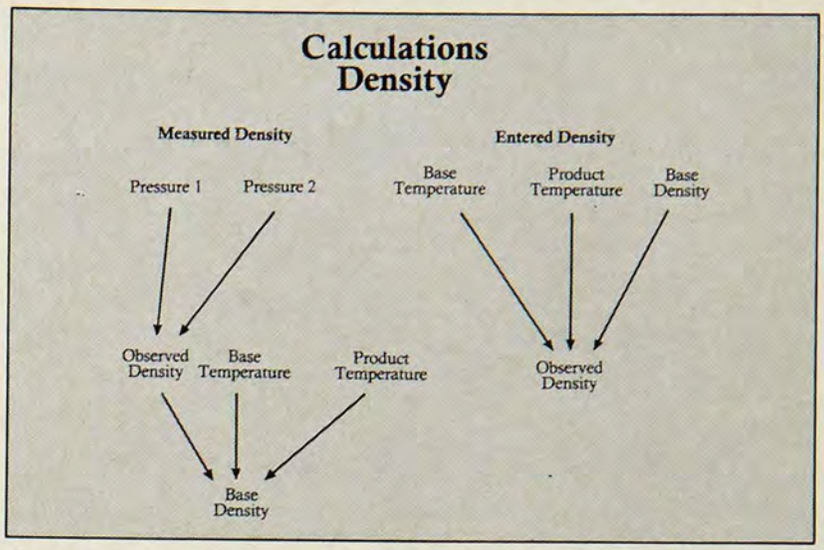


Figure 4

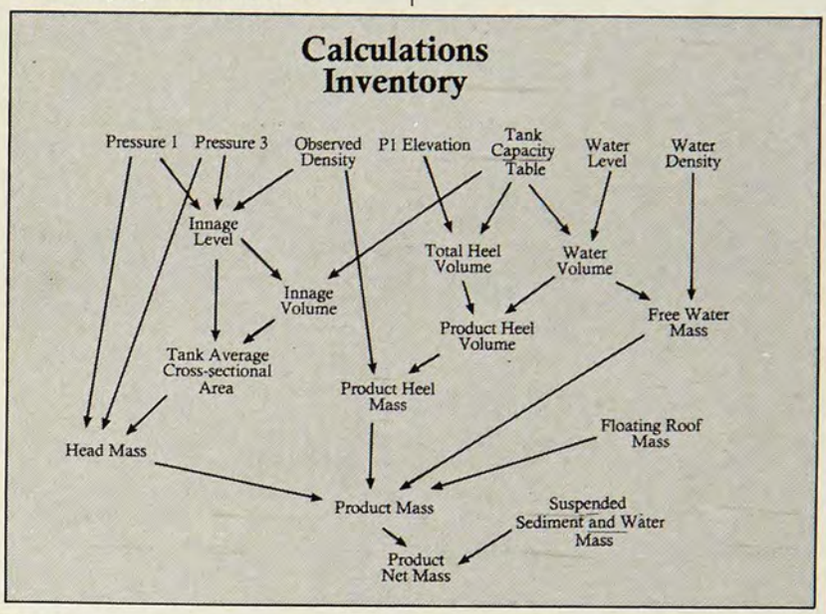


Figure 5

Usage of the standard

The standard describes:

- terminology used in HTG.
- HTG system and its components.
- inventory calculations from pressure measurements.

The standard recommends procedures for:

- tank preparation for HTG installation.
- HTG sensor installation.
- HTG sensor position measurements.
- HTG commissioning.
- HTG performance monitoring and verification.
- HTG field calibration.

The standard lists secondary effects on HTG measurements and recommends ways of minimising the effects. It recommends a method of calculating inventory accuracy from known accuracies of the pressure sensors. ■

. . . IP information service news

IP Statistics

Those who subscribe to the IP Statistical Service will be aware of the valuable statistics relating to the oil industry, which the Information department provides. Figures for **Consumption and Refinery Production** of each of the refined products are produced on a quarterly and annual basis. The set of 20 different **Oil Data Sheets**, updated regularly, provides information on such diverse topics as prices, imports, exports, reserves, production, useful addresses and conversion factors.

A new addition to the service takes the form of a **Ten Year Cumulation of Consumption and Refinery Production** figures including tables and graphical representations and has been compiled in response to the many requests received for retrospective information.

If you would like to subscribe to the service, please contact **Catherine Cosgrove** on **(071) 636 1004.**

IFEG

The Information for Energy Group, administered by the IP Information Service, brings together those working in information related posts in the energy industries. The group embraces all forms of energy — nuclear, coal, gas as well as oil, and arranges regular evening meetings and visits for its members. It also organises one or two conferences per year on subjects of major interest to its members. IFEG provides a useful forum for exchange of ideas and for making contacts.

New members are most welcome — the annual subscription of £7.50 includes a copy of the Members' Directory. For further details please contact the Secretary, **Catherine Cosgrove** on **(071) 636 1004.**

A selection of new additions to the library

Accidental Explosions: Volume 1: Physical and Chemical Properties, Volume 2: Types of Explosive Substances.
By: Medard Louis A.
Bodmin, Ellis Horwood Ltd, 1989. Class Number: 935.3

Acquiring Better Seismic Data.
By: Carr Pritchett W.
London, Chapman and Hall, 1990. Class Number: 368

Catalysts in Petroleum Refining 1989 Proceedings of the Conference on Catalysts in Petroleum Refining, Kuwait, March 5–8, 1989.
Edited by: Trimm DL, Akashah S, and Absi-Halabi M, Bishara A.
Amsterdam, Elsevier, 1990. Class Number: 721.4

Closing the Gasoline System — Control of Gasoline Emissions from the Distribution System and Vehicles.
CONCAWE.
3/90.
Brussels, Concawe, 1990. Pamphlet

Cost Reduction in Offshore Engineering.
INSTITUTION OF CIVIL ENGINEERS ICE.
London, Thomas Telford, 1990. Class Number: 539

Demand, Prices and the Refining Industry: A Case-Study of the European Oil Products Market.
OXFORD INSTITUTE FOR ENERGY STUDIES.
By: Bacon R, Chadwick M, Dargay J, Long D., Mabro R.
Oxford, Oxford University Press, 1990. Class Number: 720

Motor Vehicle Emission Regulations and Fuel Specifications — 1990 update.
CONCAWE.
2/90.
The Hague, CONCAWE, 1990. Class Number: 769.1 Pamphlet

The Petrochemical Industry in Developing Asia: A Review of the Current Situation and Prospects for Development in the 1990's.
THE WORLD BANK.
By: Vergara W, Babelon D.
World Bank Technical Paper No. 113.
Washington, World Bank, 1990.

Petrol Filling Stations: Construction and Operation.
HEALTH AND SAFETY EXECUTIVE HSE.
London, HMSO, 1990. Class Number: 935.1

Petroleum Contaminated Soils: Volume 1: Remediation Techniques Environmental Fate Risk Assessment.
By: Kostecki PT, Calabrese EJ.
Michigan, Lewes Publishers Inc. 1989. Class Number: 769.2

Petroleum Contaminated Soils: Volume 2: Remediation Techniques Environmental Fate Risk Assessment, Analytical Methodologies.
By : Kostecki PT, Calabrese EJ.
Michigan, Lewes Publishers Inc. 1989. Class Number: 769.2

Petroleum Retailing after the Monopolies Report: The Challenges of the 1990's.
INSTITUTE OF PETROLEUM.
London, INSTITUTE OF PETROLEUM, 1990. Class Number: 960 Pamphlet

The Public Inquiry into the Piper Alpha Disaster The Cullen Report.
DEPARTMENT OF ENERGY.
London, HMSO, 1990. Class Number: 935

Second North Sea Safety Conference: London Hilton on Park Lane, London W1, 12 September 1990.
TECHNOLOGY FORUM.
London, Technology Forum, 1990. Class Number: 935

Software Directory for the Offshore Industry.
HOLLOBONE HIBBERT & ASSOCIATES LTD.
London, Hollobone Hibbert & Associates Ltd, 1990. Class Number: 082 Ref/Directories

Summary Report on: A Study of the Effects of Diesel Fuel Aromatics Content on Particulate Emissions from Modern Diesel Engines.
BRITISH TECHNICAL COUNCIL OF THE MOTOR & PETROLEUM INDUSTRIES.
London, British Technical Council, 1989. Class Number: 769.1 Pamphlet

World Oil Prices: Demand, Supply, and Substitutes.
THE INTERNATIONAL RESEARCH CENTER FOR ENERGY AND ECONOMIC DEVELOPMENT ICEED.
By: Mohammad Yousuf H, Mead Walter J.
Boulder, ICEED, 1990. Class Number: 921

Worldwide Offshore Accident Databank: WOAD Statistical Report: Statistics on Accidents to Offshore Structures Engaged in Oil and Gas Activities in the Period 1970–89.
VERITEC VERITAS OFFSHORE TECHNOLOGY AND SERVICES A/S.
Hovik, Norway, VERITEC, 1990. Class Number: 935

. . . people

The sign designer and manufacturer AC Edwards plc has appointed a new Production Director, **Mr David Stidston**, below, who joins the company from Oldham Signs. The company is a supplier of signage to the petroleum retail industry, and has been heavily involved in implementing corporate re-imaging programmes for oil majors.

National Economic Research Associates (NERA) have appointed **Dr David Robinson** to head its new Madrid office. Dr Robinson was previously Director of NERA's London office and worked for the International Energy Agency before joining NERA in 1985.

Topas the distribution and logistics management computer software house, has appointed **Mrs Pat Roberts**, above, as Senior Sales Executive for Distribution and Aviation products.

Hydra-Tight Limited, the bolt tightening and in situ machining specialist, has made a number of new appointments. Mr Derek Cruickshank, above centre, has been appointed Manager of the company's Dyce based operation; he replaces Mr Phil Maxted, above right, who moves back to the company's Midlands operation. Mr Gordon Simpson, above left, has been appointed Sales Engineer, whose responsibilities include maintaining and increasing liaison with industry in the north of Scotland.

Weatherford has named two new region managers in its international oilfield services operations. **Mr Mike Audirsch** has taken over Far East operations and is based in Singapore. He most recently served as Marketing and Technical Services Manager at Weatherford's Hanover base. He replaces **Mr Horst Grundel** who is retiring. **Mr George Myles**, who headed Weatherford's UK unit in Aberdeen since 1984 is now Regional Manager, Middle East and is based in Dubai. He replaces **Ramzi Al-Heureithi**, who has become Vice President, Middle East, Mediterranean and Africa regions and relocated to the company's central European office.

Mr John Astrop has been appointed Commercial Director of Kinetica Limited, initially on secondment from PowerGen plc. His responsibilities will include the purchase, transportation and sale of natural gas and the commercial development of Kinetica's pipelines.

AmBrit International Plc have appointed **Mr Alan Beale** to the Board as a Non-Executive Director. Mr Beale recently retired from Barclays Bank as Corporate Finance Director, Energy and Utilities Department where he was responsible for the Bank's energy and mining/metals portfolio and relationships with companies in these sectors worldwide. He was previously Senior Finance Manager with the British Petroleum Company for ten years.

Amerada Hess Limited (AHL) has appointed two new Directors to the Board. **Mr Mike Unstead** who joined AHL in 1985 as Technical Manager has been appointed Director with responsibility for all operated and non-operated oilfield developments and associated oil trading. He spent 28 years working with Shell and BP prior to joining AHL and was responsible for successfully bringing AHL's first operated development, the Ivanhoe/Rob Roy fields, into production in 1989. **Mr Rex Gaisford** joined AHL in 1989 as Manager, New Projects following four years as Project Manager of the Ivanhoe/Rob Roy project. He has been appointed Director with responsibility for developing all AHL's gas and oilfield projects from design through to first production. Prior to joining AHL, he spent many years in the oil industry construction field and was previously a lecturer at the University of Manchester.

Ranger Oil Limited have appointed **Mr Alan Henderson** as Vice President, Director of Corporate Relations, Ranger Oil Limited.

Inpipe Products has appointed **Mr David Woods** to be its new General Manager. Mr Woods previously worked within a major international oil company, and suppliers of engineered systems to the oil, petrochemical and high pressure gas industries.

Core Laboratories, a division of Western Atlas International Inc, have appointed **Ann E Rosecrance**, below, to direct the quality assurance operations in Core Lab's environmental analysis and petroleum testing facilities. Prior to joining Core Laboratories, she directed environmental chemistry laboratory operations and managed analytical contracts for private industry and government agencies.

Mr Tony Barrell has been appointed Head of the new offshore safety division which is being created in the Department of Energy. Mr Barrell was previously Director of Technology with the Health and Safety Executive.

Edacom Data Systems have appointed **Mr Nick Payne**, above, to the post of National Sales Manager. He will be responsible for liaising with major accounts for the sale of EDS products including the PC based Petrol Station Management System.

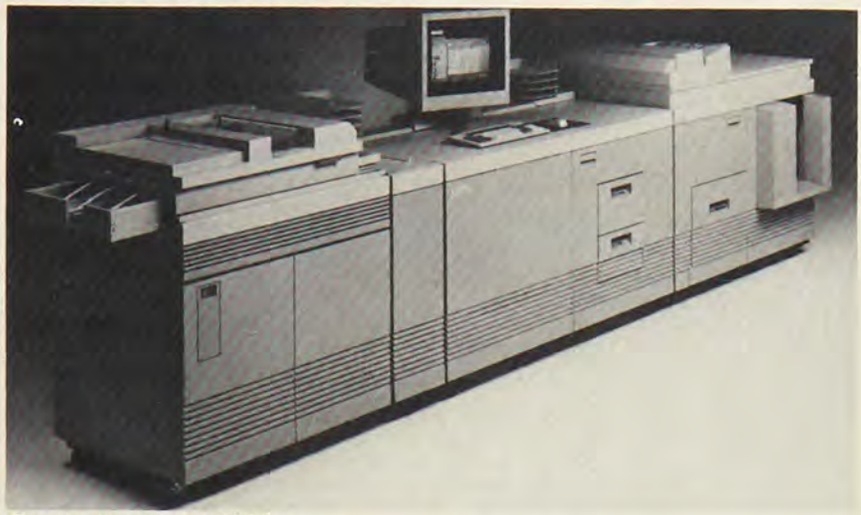
Shell try new Xerox

Shell UK's reprographic department has been putting the latest Rank Xerox product — claimed to be able to ignite a revolution in the office — through its paces during tests over the past few months.

The new Docutech Production Publisher available now is aimed at bridging the gap between computer work stations and desk top publishing systems, by merging a company's paper and electronic data networks.

Rank Xerox claims Docutech is a multifunctional device which combines the different technologies of scanning, filing, printing, finishing and networking in a single unit. It marks a new move by Rank Xerox, who created key partnerships with other companies to make the system compatible in the hardware and software arenas.

The networked publisher will be fully compatible with all the major PC's, Apple Macs and Sun workstations. Networking is made possible using a conversion gateway based on Novell's NetWare 386. Rank Xerox has also formed a partnership with Adobe, and can use a host of software from such companies as Aldus, Elixir, Intergraph, Interleaf, Intran, Ventura and WordPerfect.



One-stop document publishing

Shell have been delighted by the results, running all manner of print jobs: from a single page proof to long runs of several hundred page documents.

Trudy Whelan, Shell's Reprographic Services Manager, said: 'We have been very pleasantly surprised at the machine's versatility and have found that probably one of its most endearing features is its reliability.'

Rank Xerox is targeting the Docutech at the offset market and is ideal for printing contracts, brochures, catalogues, technical documentation, training material, directories and journals.

Bore lance

A new approach to formation penetration, a liquid jet drill — the patented Lance Penetrator Tool — is designed to improve formation-to-wellbore communication and provides an alternative to conventional perforations using explosives.

Systems programme

Sequent Computer Systems has won a £1.25 million contract to supply BP Oil with a number of UNIX-based systems in the first implementation of BP Oil's European Systems Programme (ESP).

BP's ESP programme involves 16 European countries and is aimed at implementing compatible open computer systems for accounting, stock control and sales applications. Sequent will supply four Sequent Symmetry UNIX systems, including three multiprocessor Sequent S27s, to run the accounting application for BP's pilot project in Austria and development activities in other European countries. The application will be based on the Oracle Financials software and is scheduled to go live in the spring of 1991.

Non fossil fuel

Land Fill Gas Limited has announced that eight of its schemes to produce electricity have been successfully contracted by the Twelve Regional Electricity Companies (TRECs) under the terms of the Non Fossil Fuel Obligation for Renewables. Two are in the East Midlands Electricity Plc distribution area, and, through its association with its joint venture partner, Norweb Generation Limited, six are in the Norweb Plc distribution area.

Out of a total of 75 projects, twenty five of the schemes with whom the Twelve Regional Electricity Companies have contracted in fulfilment of their obligations are for the production of electricity from landfill gas. The eight projects represent approximately 8 percent of the initial Obligation of 102.25MW.

Landfill gas is the accepted term for gas produced as a result of the anaerobic decomposition of organic material in waste disposal sites.

Bill Lee, Chairman of Land Fill Gas Limited said, 'I hope that the encouragement and assistance given to Local Authorities and the waste disposal industry generally by these developments, will lead to "designer" waste disposal sites, specifically intended to harness all gas produced, so that higher levels of efficiency and lower levels of cost can be achieved.'

Welding aid

An easy-to-apply and easy-to-remove anti-spatter masking compound for many quality welding applications, has been specially designed by Hong Kong-based Magna Industrial Co Ltd.

Delta 550 is designed to protect all treated metal surfaces from damage during arc welding.

Coolant system

BP Oil UK Limited and Mono Pumps Limited have joined forces to produce an innovative automatic coolant mixing and distribution system for the metal working industry.

The coolant distribution system offers a number of clear benefits, which translate directly into more efficient production and a healthier, safer working environment.

The heart of the system is a Mono pump unit which draws the mixed coolant from a small storage tank and is able to send it, under controlled pressure, to any of the machine tools linked to the system. A 25-litre reservoir is maintained at the correct distribution pressure to allow the machine operator to dispense adequate coolant on a consistent basis.

Offshore safety software system

Technology Transfer Systems have announced a major breakthrough in offshore safety in the wake of the Cullen Inquiry into the Piper Alpha disaster.

The new safety-oriented training and monitoring system addresses Cullen's principal criticisms — most notably, the necessity of ensuring a regular and systematic approach to training needs.

The new SafeGuard system is a sophisticated software program tailored to the practical realities of offshore human resources management. It is derived from a system initially developed for British Gas Exploration and Production and in day to day use for more than a year at both their Rough and Morecambe Bay Field management and support bases.

British Gas Expro was the first to recognise that no manual system (or standard computer program) could hope to deal quickly and infallibly with the shifting variables of offshore personnel management.

What was also needed was a system which could identify and anticipate specific worker training needs, prioritise safety-critical and non safety-critical requirements, and schedule not only individual training programmes but make precise budget forecasts as well.

SafeGuard, due for worldwide release in March, proved itself equal to all the demands made of it; fast, accurate and easily accessed (with inbuilt systems to prevent operator input error), in tests it also demonstrated an exemplary cost-effectiveness: whereas it has taken two people five full working days to prepare a corporate budget forecast for overall training needs, the system provided the same data in less than 90 minutes.

Tight seal solution

The penalty, as the oil exploration industry well knows, for being unable to dismantle tightly sealed components, can be an expensive one. The last-resort flame torch carries a heavy price tag.

A manganese phosphate dry lubricant formula developed by Armourcote, the Leeds-based surface treatment specialists, has been shown to offer a marked improvement over other techniques: not only in preventing severe galling during the tightening of close tolerance screw threads but, in separating the parts after extended use. Components joined by high torque thread connection or cone shaped interlock now stand to benefit from being faced by the manganese phosphate coating.

A convincing example has been the riser connections used in the Hutton Field which separated without difficulty after 5 years of constant use. Indeed, the coated join sections had suffered only marginally despite the 7000ft/lbs torque applied in their original assembly.

The company's ability to perform its work on site and not solely at its base in Leeds was put to the test by Kvaerner. Here, the entire preparation and coating procedure for their tension leg adjusting sections was handled by their team at the TLP assembly point in Norway.

Alternative plan for hydrates project

CALtec, the offshore fluid engineering technology centre of BHR Group based at Cranfield and Aberdeen, is currently reviewing proposals aimed at combatting the problem of hydrate formation in offshore oil and gas pipelines.

The new initiative will replace the company's plans to construct a high pressure hydrocarbons test facility at its Aberdeen premises. Rising construction costs deemed the project uneconomic.

The test facility was only one of a number of CALtec projects aimed at extending the operational range of full wellstream transfer piepelines. The other projects will continue as planned.

Since 1989, CALtec has operated the multi-sponsored research programme directed at finding solutions to the major technological problem of ice-like hydrate crystal formation in pipelines which leads to a flow restriction and ultimately to blockage of the pipeline causing expensive downtime and pipeline recovery costs, said Dr Alan Burns, CALtec's Managing Director.

'The first phase of the project covering small-scale laboratory tests and modelling studies is now complete, with results shortly being presented to sponsors. The next stage of the programme was scheduled to be the construction of a high pressure hydrocarbons test facility capable of reproducing conditions prevailing in an operational offshore pipeline, in a controllable onshore environment.'

'During the course of the initial phase,' adds Dr Burns, 'The cost of the process plant for the test facility escalated to such a degree that made future operation of the facility uneconomic. As a result, CALtec and the project sponsors have agreed to discontinue the present research programme to investigate hydrate formation on completion of the current phase of the work schedule.'

Existing CALtec research projects aimed at subsea pipeline operation, including the MPE — Multiphase Pipelines and Equipment — consortium project, are unaffected by this decision.

Rupture disk

The new fail-safe CSR Reverse Buckling disk for the chemical and petrochemical industries is being launched by BS&B Safety Systems based in Sheen, London. If accidentally damaged or installed upside down, the CSR disk will relieve pressure by bursting with full opening, below its rated burst pressure, ensuring that full system protection processes remain undamaged.

The CSR disk will operate at pressures up to 90 percent of its rated burst pressure and requires no support under vacuum. When overpressure occurs, in either liquid or gas applications, the disk reverses and shears along a circular score line. The disk opens fully without fragmentation avoiding damage to downstream equipment or process contamination. The smooth disk surface towards the process medium also resists product built-up.

BT direct dial link

Oilmen in British waters can now make phone calls by radio to the UK mainland — and the rest of the world — by direct dialling from their rig.

The new Autolink RT service is the first anywhere to provide automatic direct dialling by radiotelephone on both medium frequency (MF) and very high frequency (VHF).

Direct dialling avoids the need to call a British Telecom coast radio station officer, giving faster call connection.

The new service enables vessels and the offshore oil and gas exploration industry, to continue using their existing radio equipment. The inclusion of MF means that calls be made up to 200 miles out to sea, whereas VHF has a range of about 40 miles.

Previously, maritime direct dialling from British Telecom has been available only via satellite. Other telecommunications operators offer a VHF-only service.

British Telecom's Humber Radio station started to offer the service last November; the entire network of 33 stations will be completed this year. Some 70 MF and VHF channels will eventually be available for Autolink RT customers.

In addition, Autolink RT offers call scrambling from coast stations for extra radio security.

Customers need to register with British Telecom for the service, but there is no registration or rental charge. On registration, they are supplied with personal identification numbers (PINs) for each individual user. Rigs can be issued with up to 99 PIN numbers for members of crew or contractors.

Offshore blast barrier

Cape Durasteel Limited have invested over £250,000 in a development programme spanning several months, which has created the first complete blast barrier structure, specifically designed for offshore platforms.

Independent tests at Fire Research Station Testing Centre, Cardington, subjected the Durasteel structure to a series of nine consecutive gas explosions, creating blast pressures reaching a staggering 2.0 bar.

Quick assembly connection concept

Described as 'a new concept in connection', Legris have launched a unique quick assembly barbed fitting and a range of self fastening tubes. Legris claims the system is both rapid and economical.

The system works under pressure, the textile braid in the tube shrinks to increase adhesion to the nozzle.

The new quick assembly nozzle consists of a swivelling barbed fitting, brass compression fitting and tapered male barbed stud in nine sizes between six and 22mm diameter.

The non-bursting or ejection pressure of the fitting, in static position, is always more than 60 bar, with a working pressure of 16 bar.

Cracking additive

INTERCAT has introduced a new FCC catalyst additive enabling refiners to effectively pre-crack the high boiling components in heavy oils and simultaneously reduce the FCC catalyst make-up rates required due to heavy metals contamination associated with processing these feeds.

The additive, called BCA-105, cracks the components in FCC feed which boil above 800°F (427°C) to smaller molecules which are able to pass through the openings in the zeolite crystal for further cracking.

New camera

Osprey Electronics Ltd, the market leader in the design and manufacture of underwater television equipment, has developed a new colour camera designed for use by the oil and gas industry for inspection purposes.

The camera was unveiled by the company during the recent IRM/ROV Exhibition and Conference in Aberdeen. In addition to rugged construction and compact size, the Osprey OE1362 camera incorporates the latest in solid state sensor technology.

Turbid technology

New from the Tintometer Limited is a really reliable and accurate Turbidity Meter — an important addition to the Lovibond® range of high quality water analysis systems. In fact, not one but two state-of-the-art Turbidity Meters are on offer; one portable, the other intended primarily for laboratory use.

Both instruments are true nephelometers and use a patented 'Solid Optical Geometry' to measure cloudiness in liquids, so the user never needs to be concerned with making adjustments to the numerous precision optical elements, other than normal lamp replacement.

Warning signs

Bedfordshire-based Sahlins Clydesdale Ltd have announced a complete system for creating highly legible and weather-resistant hazard warnings, numbering or marker signs and informational or directional signs called Powerplate H25.

Originally introduced as a safety measure in the electricity distribution industry the system clearly identifies cables, pipes, tunnels, routes, loading and parking bays etc., or warns employees or the public of potential dangers.

Institute News

Around the Branches

Aberdeen

8 January: 'A Review of late life development of Forties field' by Mr Phil Dimmock, Manager BP Forties, BP Petroleum Development Ltd.

12 February: AGM at The International Drilling and Downhole Technology Centre, Offshore Technology Park, Aberdeen. Presentation by Mr David Curry, Managing Director.

Edinburgh and South East Scotland

10 January: 'Refinery optimisation: use of control to maximise profit' by Mr J Warrent, BP Oil.

27 February: 'Commissioning' by Dr G Sachs, Leeds University (Joint meeting as guests of the Institute of Chemical Engineers at Training Centre, ICI Fine Chemicals Plant, Grangemouth).

Essex

9 January: 'Engine testing of lubricants' by a speaker from Research and Technical Service Laboratory, Mobil Oil Company Ltd.

13 February: 'Bitumen, Ancient and Modern' by T S Hoben, Technical Manager, Shell Bitumen.

Humber

17 January: 'Humberside Airport helicopter operations'. Speaker to be announced.

7 February: AGM followed by a lecture on 'The proposed development of the Immingham Bulk Terminal' by a speaker from Associated British Ports.

London

16 January: 'Aviation fuel quality control' by Mr J W Earl, International Aviation, Shell International Trading Company.

19 February: 'Alternative transport fuels of the future'. Speaker to be announced.

Midlands

16 January: 'Hydrocarbons in food' by Dr David Lees, MAFF.

18 January: IP/BLF Dinner Dance.

13 February: AGM followed by a talk entitled 'A History of the British Pub' by Mr Maurice Lovett. To be held at Edgar Vaughan and Co. Ltd, Birmingham.

Northern

15 January: 'The effect of unleaded fuels on engine design' by Mr John Hillier, BP.

12 February: AGM followed by a talk by Professor Glyn Morton.

South Wales

24 January: 'Plastic waste management and challenge' by Mr W Moffit, Environmental Consultant to British Plastics Federation, at Texaco Refinery, Pembroke.

16 February: Visit to BP Wytch Farm development, Dorset.

21 February: AGM and 'Garden Festival Wales 1992' by Mr G Cripps, Garden Festival Wales Limited, at Stradey Park Hotel, Llanelly.

Stanlow

23 January: AGM followed by 'CIA's work on issues facing the petrochemical industry' by Mr David Culpin, Director of Business Development, CIA.

20 February: 'Technology of burning Orimulsions' by Mr Hancock, Power Gen.

West of Scotland

7 March: Petroleum Dinner.

Yorkshire

8 January: 'Changing lifestyles in the environment' by Mr M Portlock, Technical Manager, Shell Oils.

12 February: Joint meeting with the Institute of Energy.

New Collective Member

Singapore Petroleum Company (SPC) is the only independent oil refiner in Singapore. The company has a one-third share of the 190,000 bpd capacity in the Singapore Refining Company refinery — one of the most modern and sophisticated refineries in the region. Together with its group of companies, SPC engages in a wide range of activities which include oil refining, marketing and distribution, trading of crudes and petroleum products, third-party processing and tanker transportation. It has substantial dealings with a host of international customers and suppliers which include major oil companies, oil traders, brokers, international airlines and shipping companies.

Benevolent Fund

The Institute of Petroleum has a Benevolent Fund for the provision of financial and other relief or assistance to persons in need who are or have been members of the Institute and the wives, widows, families and dependent relatives of such persons as the Management Trustees in their absolute discretion think fit. If members of the Institute are aware of any such persons, even if their membership of the Institute has ceased, they are asked to inform Mr AEH Williams at the Institute. Applicants would be asked to complete a form giving details of their financial circumstances which would be treated in strict confidence. Help might be given for temporary difficulties, such as the cost of convalescence following illness.

Deliveries into Consumption

UK deliveries into inland consumption of major petroleum products —Tonnes

Products	*Oct 1989**	*Oct 1990**	*Jan–Oct 1989†*	*Jan–Oct 1990**	*% change*
Naphtha/LDF	325,250	189,570	2,701,950	2,519,120	−6.8
ATF—Kerosine	589,610	569,330	5,606,400	5,652,940	0.8
Motor Spirit	2,040,980	2,049,160	19,932,920	20,346,400	2.1
of which unleaded	559,660	769,610	3,511,472	6,323,160	80.1
Super unleaded	n/a	84,220	n/a	759,080	
Premium unleaded	n/a	685,390	n/a	5,564,080	
Burning Oil	161,470	115,070	1,466,430	1,607,770	9.6
Derv Fuel	903,240	912,430	8,400,950	8,912,910	6.1
Gas/Diesel Oil	682,960	617,410	6,810,980	6,601,370	−3.1
Fuel Oil	1,071,120	634,220	8,191,930	10,335,614	26.2
Lubricating Oil	73,720	79,360	740,590	707,564	−4.5
Other Products	590,240	482,270	5,505,550	5,370,292	−2.5
Total above	6,438,590	5,648,820	59,357,700	61,830,620	4.2
Refinery Consumption	444,710	432,040	4,805,920	4,839,650	0.7
Total all products	6,883,300	6,080,860	64,163,620	66,670,270	3.9

†Revised *Preliminary n/a not available