OCTOBER 1992

The Institute of Petroleum

PETROLEUM REVIEW

Cadman Lecture

Lo van Wachem gives the Cadman Lecture

Subsea

A survey of processes and products, recovery systems and standardisation needs

Piper B

Details of safety innovations

Australia

Woodside's drilling record

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Cover photo of Lo van Wachem, Cadman medallist, with IP President Charles Smith (left). Photo by Jon Whitbourne

. . . news in brief

15 August

Oil output in the Commonwealth of Independent States fell 12 percent in the first six months of 1992.

18 August

US oil companies Sun and Atlantic Richfield (Arco) have reached agreement with Iran over compensation payments for the expropriation of assets after the Islamic revolution in 1979.

Price Waterhouse and solicitors Clifford Chance have been appointed by the Hungarian government as regulatory and legal advisers for the privatisation of the gas distribution industry.

Texaco has discovered oil with its first exploration well in Tunisia. The onshore El Jem-1 well tested at 3,600 barrels of oil and 3.7m cu ft of gas per day through a restricted choke.

19 August

Brabant Resources is acquiring the UK onshore and offshore interests, including 12.71 percent of the Buchan field, from Monument Oil and Gas in a £2.525 million deal.

20 August

Barclays Bank will fund 80 percent of an $11.5m wind farm at Coal Clough, near Burnley, Lancashire, with a six year loan.

21 August

Enron Europe has purchased Chevron's 25 percent share in the J-Block in the central North Sea comprising the Joanne and Judy fields. The deal also provides for Enron to purchase Chevron's 25 percent interest in North Sea block 30/7b.

A partnership led by British Gas has won a contract to build and operate a £175 million plant to serve a major petrochemical complex in Thailand.

22 August

Lasmo and C Itoh of Japan signed a contract with Vietnam to look for oil off the country's continental shelf.

Mr Ren Dahan was elected president of Exxon Co International and a vice president of Exxon Corp in succession to Mr Sidney Reso who died after being abducted last May.

23 August

Irish oil independent Aran Energy has agreed to let Mobil North Sea farm into a group of four blocks in the Irish sector of the Celtic Sea where both companies intend to drill next year.

25 August

US oil company Sun is to cut 200 out of 490 jobs at its Tulsa refinery and concentrate on the plant's profitable lubricants and wax business.

27 August

A consortium comprising Enterprise Oil and Compagnie Europeene des Petroles revealed that preliminary data indicates that there may be petroleum deposits off the Cambodian coast according to offshore seismic studies.

29 August

British Borneo Petroleum Syndicate, the oil and gas production and investment company, has conditionally agreed to acquire Mobil Corporation's 10 percent interest in the Victor gas field in the North Sea for £21.4 million.

The first purpose-designed North Sea standby vessel, taking on board the recommendations of the Cullen inquiry, and designed by IMT Marine Consultants, is to be built in the UK by Yorkshire Dry Dock Co in Hull.

2 September

Mobil Exploration Indonesia has agreed with Pertamina to extend its North Sumatra offshore production sharing contract until 2018.

3 September

British Petroleum and Statoil announced an agreement with Azerbaijan to carry out studies leading to the development of a major offshore field and exploration of adjacent acreage in the Azeri sector of the Caspian Sea.

Prince Charles inaugurated BP's new Miller platform — oil began flowing in June and is peaking at 135,000 barrels per day.

4 September

Mr Gregers Kure resigned as president of Aker's oil and gas technology unit following renewed financial problems at leading concrete platform builder Norwegian Contractors.

10 September

A US Federal appeals court revived a lawsuit by Chevron against Pennzoil charging that Pennzoil illegally masked its intent to gain partial control over Chevron in a 1989 stock purchase. The court ruled that Chevron had a right to a trial on its claim. A lower court judge dismissed the case in 1990.

Mobil has been given the go-ahead by the Department of Trade and Industry for the £50–60m development of the Excalibur gas field in the southern North Sea.

British Borneo Petroleum reported a sharp increase in interim net profits to £2.07m from £1.43 last time.

12 September

British Gas has been asked by the Gas Authority of India and the Maharashtra state government to supply gas to Bombay.

Norwegian drilling rig owner Wilrig is continuing to run down its Aberdeen-based operation due to lack of drilling activity in the UK sector of the North Sea.

15 September

Hardy Oil and Gas has boosted its Canadian operations by 1.2 million barrels of oil by buying Bashaw Minerals and some assets of Stateside Energy Corporation.

Kingston Oil and Gas revealed a 72 percent slump in pre-tax profits at the half-year.

16 September

Elf is facing an environmental protest over plans to sink the North-East Frigg platform in Norway's Nedstrand fjord when gas production stops in 1993.

A campaign to win lower Suez Canal tolls for environmentally friendly vessels has been initiated by the International Association of Independent Tanker Owners.

Occidental has signed a production sharing contract with the Angolan national oil company, Sonangol, to explore the 600,000 acre onshore Cabinda North block.

Petronas, Malaysia's state-owned oil company, has confirmed that the Idemitsu Kosan company of Japan has pulled out of a venture to build an oil refinery near Malacca on Malaysia's west coast.

Saipem, the engineering services subsidiary of ENI, and private-sector Tecnologie Progretti Lavori have been awarded a $1.7bn contract by the National Iranian Oil Company to develop the Gulf offshore South Pars gas field.

Repsol is to delay a placing of about 10 percent of its equity until next year to allow the Spanish parliament to lift legal barriers to the deal.

Powergen claimed to have broken new ground with the first spot related sale of gas. The deal involved a delivery to Southern and Phillips for a short period to fill a supply gap in a contract with a customer.

Open all hours.

Our pipelines are open to other gas suppliers who need to get gas to their customers in industry and commerce.

In the last year the number of sites supplied with gas by competitors using the British Gas pipeline system has increased from fewer than 1,000 to more than 5,000. Over one-third of all the gas used in the firm industrial and commercial market is now supplied by competitors of British Gas. And the competition continues to grow.

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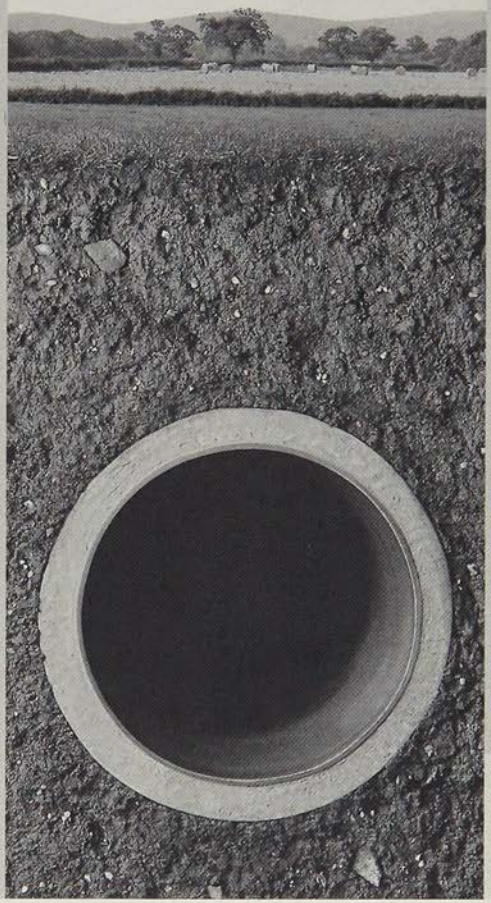


In addition we will be offering new services such as gas storage and low-cost interruptible gas transportation. So now, British Gas really is open for business in a big way.

To help you make the best use of our pipelines and other facilities, we've produced a new edition of our Gas Transportation brochure. It describes the services we offer and the prices that will apply in the next 12 months.

If you would like a copy or more information, please dial Freephone 0800 220358 or write to: John Huggins, Director, Gas Transportation, 22nd Floor, Millbank Tower, London SW1P 4QP.

British Gas

MCS JOB NUMBER: 4568 DATE: 4/9/92 CLIENT: YOUNG & RUBICAM
JOB NAME: 4568/BG OAH/253x177 LOCATION: BRITISH GAS FOLDER PROOF: 2 PAGE: 1
OPERATOR: mat FONTS: BRITISH GAS CUSTOM FONTS SIZE: 250x177mm SCREEN: 100#
PUBLICATION: Petroleum Preview

Norway hints at flexibility

The Norwegian government is considering changes to its licensing regime in order to attract and maintain investment in the Norwegian Continental Shelf oil and gas fields. It has also announced a package of governmental changes including the merger of the Department of Energy and the Department of Industry.

Although this move is broadly similar to the reshuffle that occurred this year in Britain, Norway's Energy Ministry has not held responsibility for safety since the mid 1970s. This has rested with the Norwegian Petroleum Directorate.

Energy Minister Finn Kristensen, who will lead the new department, told delegates at the Offshore Northern Seas conference in Stavanger, Norway, that the government is reviewing its commitment on state participation in all offshore developments and is considering a 'more flexible system — working in both directions — for state participation'.

'We would like to be more flexible in our approach in order to continue to attract developers who will provide the most benefit to Norway in the utilisation of its reserves. We will evaluate the present rules in light of developments in other countries,' he said.

The increasing signs of flexibility are likely to be welcomed by oil companies keen to maintain exploration activity in the politically stable region. With large areas of the Far East, Central Asia and Africa opening up to Western investment, however, the strain on exploration capital in a period of low oil prices is acute.

Mr Kristensen added that the government would maintain its right to participation.

Although he personally would welcome moves towards membership of the European Community (EC) for Norway, Mr Kristensen stressed that the country would 'strongly resist' attempts by the EC to dictate state participation decisions he believed to be rightly held by Norway. The government would seek to negotiate on any directives concerning state participation before seeking admittance to the EC. He did not, however see any problems that were 'insurmountable'.

Concern was also expressed over the proposed gas transport directive, currently being revised. He stated that any proposals that made it more difficult to enter into long-term contracts will have a negative effect on field development particularly in relation to larger gas fields and the establishment of infrastructure.

Retail opportunities search

A new joint venture company has been launched to find fuel related development opportunities in England and Wales.

Land developers, Thornfield Holdings plc, and fuel suppliers and retailers, Bayford, have formed Bayford Thornfield Petroleum (BTP) Limited and are searching for urban sites with potential for fuel led development.

A spokesmen for the company said it was interested in anything from half an acre to 15 acres. 'The company would also look at redeveloping existing petrol filling stations, preferably free of tie, disused industrial buildings or any land adjacent to arterial routes with potential.'

The company, based in Leeds, is also targeting greenfield sites on existing or proposed major roads.

Elf chief's gas warning

The natural gas market in Europe will continue to increase but it faces risks including substantial price increases as more marginal, remote fields are developed to service the demand.

This is the view put forward by Mr Loik Le Floch-Prigent, president and chairman of the Elf Aquitaine group, at a strategic energy issues conference in Stavanger.

The sources of gas are 'located further and further away, which means that [extraction] costs will increase' he said.

As Norway is Western Europe's major producer he was 'anxious' to see more activity particularly in order to serve German demand and raised the possibility of a fourth gas pipeline to mainland Europe.

Elf will also be seeking more operatorships on the Norwegian Continental Shelf as Mr Le Floch-Prigent stressed the company's commitment to the long-term development of the countries reserves.

Although no official announcement has yet been made, the company is 'excited' by its HP/HT well drilling programme north of the Frigg field.

Elf is committed to its objective of increasing its production to 1 million barrels a year. Drilling successes in the North Sea and Africa as well as purchases had added to the company's reserves and Mr Le Floch-Prigent was confident the company will reach its goal within two to three years.

Appraisal success

LASMO North Sea has successfully tested appraisal well 16/12a–17 on the Pine field in the UK North Sea.

The well produced 37° API oil at a rate of 7,200 barrels of oil per day and gas at a rate of 5.8 million cubic feet per day with a wellhead pressure of 1,542 psi.

Managing Director John Hogan said that the company was 'extremely' pleased with the results and said that the latest information will help the company reach a decision on development of the 16/12a accumulations. As well as the Pine field, the block includes the North Birch and South Birch accumulations.

Annex B consent

Mobil has received Annex B consent from the Minister of Energy, Mr Tim Eggar, to develop the Excaliber gas field, 60 kilometres north of Bacton.

The field, discovered in 1988, has estimated recoverable reserves of 253 billion cubic feet of gas. Production start-up is scheduled for October 1994.

Hurricane damage

Damage to oil operations in the Gulf of Mexico as a result of Hurricane Andrew is likely to lead to the largest insurance claims on the offshore energy account since the destruction of the Piper Alpha platform in July 1988.

The damage, according to international offshore loss adjusters Rush Johnson Associates, is more substantial and widespread than first estimated. However, although aggregate claims will be heavy these are likely to be spread around several insurance markets.

Most recent figures indicate that of the 2,000 structures exposed to the storm some 34 were toppled, 28 were leaning and 104 suffered other damage.

Five drilling rigs were also set adrift and two, the Zane Barnes and the Marlin 3, suffered major damage.

Concern has also been expressed that 83 pipeline segments have also been reported damaged. Seven small oil spills were reported.

The hurricane forced the shut in of 20 percent of oil and gas production from the Gulf of Mexico.

OPEC countries seek technology

OPEC countries are investigating more flexible approaches to oil companies in an attempt to attract technological investment, capital and training.

In a speech delivered on behalf of Dr Subroto, Secretary General of OPEC, at the opening afternoon session of the Offshore Northern Seas Conference, Dr M Al Sahlawi told delegates that while demand for OPEC oil will increase . . .' it is quite evident that without the technological achievements of your engineers and project managers here in the North Sea, our commonly held hopes of opening up new business and boosting production capacity around the world will not be realised'.

OPEC is, he said, seeking untrammelled access to technology and finance to unlock the resources at its disposal.

Individual countries are taking steps to attract investment and build a skills base in the industry:

- In Saudi Arabia there are plans to create a reservoir of industrial management expertise among the new generation of university graduates.
- In Kuwait, BP has agreed to help to redevelop the oil industry for a cash payment based, among other considerations, on the level of technology transfer and training undertaken.
- Nigeria has launched a programme of institutional manpower training for the oil and gas industries in which oil companies are expressly invited to participate. The country has also enacted the first new joint operating agreement since 1956 — providing for an increased guaranteed margin of return on investment.
- Latin American countries have discussed a protocol for the exchange of oil related high technology and reciprocal training programmes.
- In Algeria, specific contractural commitments were undertaken by Phillips and Atlantic Richfield to train national oil company personnel. Foreign investment in enhanced oil recovery may be compensated with a portion of the extra oil lifted at a discount.
- Venezuela has finalised certain ground rules for strategic associations with foreign oil companies linking exploration privileges to long-term commitments to the refining and distribution sectors.
- Ecuador has resolved to privatise all risk activities that demand large capital investment although the necessary tax incentives have not yet been passed.
- Iran favours the use of foreign credits. The national oil company has, for the last year, been discussing joint upstream investment deals with European companies with funds being secured against the commitment of future production.
- Iraq has suggested that investments made by the foreign companies may be repaid in the form of price discounts on future crude deliveries.
- In Gabon, a 25 percent ceiling on national oil company participation was introduced under a new model clause whereas previously the state had insisted on at least 25 percent.

Billion dollar mark

Hamble Oil Terminal exports passed the $1 billion mark for crude oil with BP's 100th cargo since the terminal began exporting oil from the Wytch Farm oilfield two years ago.

Hamble has received over 6.5 million tonnes of oil and the company says that this mark has been achieved without a single oil spillage.

Azerbaijan alliance

The BP-Statoil alliance has reached an agreement with the Azeri government on the development of a major offshore field in the southern Caspian Sea.

Under the terms of the agreement signed in Baku, BP-Statoil will conduct a detailed evaluation of the undeveloped Dostlug oilfield and the near-by Shak Deniz prospect area. Current estimates place the level of recoverable reserves of the Dostlug field at 1 billion barrels. The 200 square kilometre Shak Deniz prospect contains prospective structures but has yet to be tested.

BP Exploration Chief Executive John Browne said that he envisaged that this development would be the first step of a major project. BP-Statoil has paid a fee of $40 million for the exclusive right to evaluate the field and prospect with a further payment to be made when the production sharing contract and associated agreements are ratified by the Azeri government.

Markham topsides installed

The installation of the topsides on the Markham platform has been completed bringing the first export of UK gas to Europe closer to realisation.

The field, which straddles the Dutch and UK shelf, is operated by LASMO Nederland BV a subsidiary of LASMO plc. The company has already re-entered and completed two wells and drilled two development wells using the jacket as a template.

First gas is scheduled for the fourth quarter.

THERMIE 1993 project call

The Commission for the European Community has announced the 1993 'Call for Projects' for THERMIE.

THERMIE is the European Community's programme for the promotion of new and innovative energy technologies. It operates in the fields of rational use of energy, renewable energy sources, solid fuels and hydrocarbons. Through THERMIE, eligible projects can receive financial support of up to 40 percent of total costs.

In the first two years of THERMIE around 150 million ECU (£107 million) was allocated by the Commission to more than 200 projects. A similar amount is expected to be allocated for projects selected for the 1993 call.

In the 1993 call, the Commission is giving preference to projects capable of reducing CO_2 emissions in the Community in line with the EC objective of stabilising these emissions at their 1990 levels by the year 2000. Particular emphasis is being given to projects in the areas of energy savings and CO_2 reductions in buildings and integrated systems of urban traffic management.

The call is open until 16.00 hours, 1 December.

Docks site revamp

Charringtons is to demolish its filling station serving ferry passengers at Dover Docks and to build a state-of-the-art station in its place.

The redevelopment comes just 18 months before services are due to begin on the Channel Tunnel rail link. A spokesman for Charringtons said that, despite the obvious threat from the tunnel, this investment showed confidence in the future of Dover as a cross channel port.

The filling station at Dover Docks had last been redeveloped 10 years ago. The new site is expected to open before Christmas.

Tankers facing neglect

Problems facing the ship scrapping industry is preventing the scrapping of obsolete tonnage leading to sub-standard operations and low freight rates.

The problems have been raised by Dewry Shipping Consultants who blame the low value of ferrous scrap, the large tonnages of redundant ships and 'minimum standard operators' for current industry problems.

'Until now the scrap sector has not been faced with such a high volume of redundant large ships — whether million barrel, VL/ULCC tankers, combination carriers or Capesize bulk carriers.

'The key factor in the whole ship scrap conundrum is that while ship scrapping is now vitally important to the well-being of the shipping industry, ship scrap is virtually irrelevant in the pricing mechanisms of the global ferrous scrap market.'

Scrapping incentive schemes are being promoted but critics feel they will ultimately fail as they require owners of 'good' tonnage to enable owners of redundant tonnage to receive more than the scrap value from the ship-breakers. This could encourage owners of poor tonnage to continue to neglect the units.

If, the report suggests, owners of better tonnage are forced to sell through poor trading conditions, this could be acquired by the minimum standard operators and 'the whole disastrous downward spiral will be perpetuated'.

Ecuador intends to leave OPEC

Ecuador has announced that it intends to withdraw from full membership of OPEC. The decision was made after the Vienna meeting of the oil exporters group and is understood to be caused by the country's dissatisfaction with its quota.

It wishes to increase oil production to help pay off its $13 billion foreign debt.

The withdrawal is unlikely to have anything other than a symbolic effect on the group but comes at a time when OPEC has been weakened by Iran's refusal to sign the latest production agreement.

Turnover down on lower oil price

Enterprise oil has reported a drop in turnover of two percent to £239.5 million despite a 5.9 percent lift in production in the six months ended 30 June 1992.

The company cited lower average realised oil prices and a fall in net interest income reflecting recent high levels of capital expenditure for the results. Despite this, the Board maintained an unchanged interim dividend per share of 6.5 pence.

Second sale of Brae gas agreed

Five members of the Brae Group have reached agreement with National Power PLC for the sale of a second tranche of gas from the Brae fields.

The quantity of gas involved is around 50 million cubic feet per day over a 15 year delivery period, with first delivery to commence in the second half of 1994. This represents an additional sale of over 250 billion cubic feet of Brae fields gas reserves.

The sources of gas for delivery under the contract will be from the South, North, Central and East Brae fields situated 155 miles northeast of Aberdeen, in North Sea blocks 16/7a, 16/3a, and 16/3b. The gas will be delivered to National Power PLC at St. Fergus in Scotland via the SAGE gas transportation system. The Brae Group have a 50 percent ownership in the SAGE system in a joint venture with Mobil and the Beryl Group. This provides the Brae Group with, nominally, 575 million cubic feet per day of capacity in the system.

European E3 tanker project launched

The innovative new E3 — Ecological, Economical, European — tanker design, developed by a consortium of five leading European shipbuilders, was unveiled at a world premiere presentation in London.

The first co-operative venture of its kind in Europe, the new environmentally-friendly, 280,000 dwt double hull VLCC, which has a two million barrel capacity, aims to exceed all existing and foreseen environmental regulations.

It was developed by Astilleros Españoles of Spain, Bremer Vulkan and Howaldtswerke Deutsche Werft of Germany, Chantiers de l'Atlantique of France and Fincantieri of Italy, with each yard having specific areas of responsibility according to their particular expertise.

The European re-entry into the VLCC market was prompted by the renewed international interest in controlling accidental oil pollution from tankers, coupled with the obsolescence of the existing large tanker fleet.

The prevention of accidental pollution was therefore given a very high priority in the design development. The objective was ambitiously set at zero pollution, so that oil tankers would cease to be 'the dark monsters' of the seas.

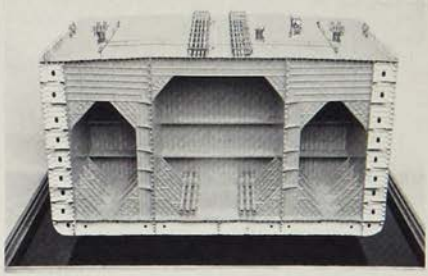
As a consequence, safety was also a very important element in the development of the E3 project.

Despite many new design characteristics totally novel in oil tankers, the E3 will be financially competitive although no price has yet been indicated. Careful attention was paid to the economics of operation, a crucial goal being to produce a ship of high value but low capital cost.

To this end, design and construction costs will be lowered by the combined know-how of the five large and experienced shipbuilders, as well as by the possibility of integrated procurement. The E3 tanker is also designed for low running costs.

The collectively designed modular superstructure will be available to the individual yards for adaptation and fine-tuning in accordance with the needs of their specific clients and production facilities.

The consortium hopes first deliveries of the E3 tanker, now being offered to shipowners, will be in early 1994. The workload of a series order can be distributed between the partner yards, and the current combined potential output is about ten ships per year.



EXPLORATION AND PRODUCTION DISCUSSION GROUP

The next meeting of the E&P Discussion Group will be held at the Institute on **Wednesday, 28 October 1992** starting at 5.30 pm. (Tea and biscuits will be available from 5.00 pm.)

Effect of EC Single Market Directives on the Upstream Industry

Speaker: **Lynette Marne**, Marathon International Petroleum (GB) Ltd

If you would like to attend this meeting please contact **Mr J Hayes,** Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Tel: 071-636 1004.

'Standardisation is not the magical solution'

By Gary A Shaw, Business Unit Manager,
Subsea Production, ABB Vetco Gray, Aberdeen

Standardisation has been a relatively high profile topic for the subsea industry for some time. In many areas of the business it has been deemed a strategic imperative, since it is critical to the long-term growth and competitiveness of the subsea production market segment.

The definition of standardisation is viewed quite differently by the various operators and service companies and this has resulted in a wide variety of programmes and efforts, a brief summary of which will be provided illustrating the current state.

As an industry, we seem to have reached the conclusion that the costs associated with subsea production developments are excessive, resulting in the focus on standardisation.

One major point to note is that, although the subsea industry is a worldwide business, the majority of the aspects and data contained here pertain to the North Sea.

Predicting the future of the Subsea Industry is only slightly less risky than Russian Roulette. No matter what journal or author one listens to, you can find one which agrees with what you want to hear. The simple fact is that we are moving into the 1990s where subsea developments are the focus of many operators who are constrained by cash deficits and declining profitability.

We should bear in mind that almost without exception, every projection for this market in the past has been overly optimistic. A more realistic picture, and probably the one we should use for base case planning, would be an industry which is reaching maturity and will experience low to moderate growth over the next few years.

The primary factors contributing to higher forecasted usage of subsea completions are:

- Safe, proven technologies
- Lower than planned maintenance costs
- Well developed field infrastructures making step-outs less costly
- Lower capital investments than conventional approaches
- Faster return on investments.

Bearing these obvious benefits in mind, we should then focus on what the perceived restraints are which could prevent market growth:

- High costs of subsea equipment
- High inventory and maintenance costs of installation/workover equipment
- Supplier capacity
- Installation risks/costs
- Workover costs.

These seem to be the prime factors dictating the actions being undertaken in the industry, the most notable of which are current standardisation efforts. With this in mind, we examined the last 10–15 subsea projects which have been either cancelled or delayed, to explore the drivers involved. The reasons most often cited were — difficulties in partner negotiations (tariff agreements etc), the establishment of better reservoir data which either changed the development scenario or eliminated it altogether or a shift in development priorities. Although this survey is not conclusive in its own right, it is interesting to note that in only one case was high equipment cost the attributed reason for cancellation.

When reviewing the subsea production market we should recognise that it is a business similar to many other businesses. If market projections are to be believed, we are in the 'late growth-to-maturity' phase of the business cycle. This tells us that high costs, prices and investment levels should be flattening and even declining over the coming years. In fact, we may be further into the maturity phase than we believe.

A review of pricing levels for a typical tree, tubing hanger and tree cap in the North Sea going back to the late 1970s shows that the base equipment prices have not changed. In fact, on a net present value basis and bearing in mind that today's completions are of a much higher technical specification, prices have steadily decreased over time. As market growth continues and the competitive environment intensifies, the industry will continue to benefit from the learning curve. Costs, and hence prices, will continue to decline.

What must be realised from this is that standardisation is not the magical solution by which to spur growth in this industry. It is a trend and one of the tools by which we can lower certain elements of our cost base, if focused in the correct manner.

If focused in the wrong areas, standardisation could stagnate the market and create a higher level of proliferation of equipment designs and execution systems than currently exists.

Present status

The industry players are now implementing various standardisation efforts. **Figure 1** provides a quick overview of at least some of these efforts. It is interesting that the objective of all the programmes appears to be to lower costs and yet the

Current standardisation initiatives

■API 17D	Performance specification for subsea equipment
■Norsk Hydro	Workover riser/tree interface
■Statoil	Workover riser/tree interface Field development concept
■BP	Functional specification approach Universal wellhead
■EEC	Same basic tree designs since 1985, same workover riser with interchangeable LRP connector
■Shell (internal)	Standardisation Spearhead Pelican
■Shell (external)	Riser system interface programme (with Texaco, BP, Marathon, Amerada Hess)
■Supply companies	Contract standardisation
■Rental market	Workover systems

Figure 1

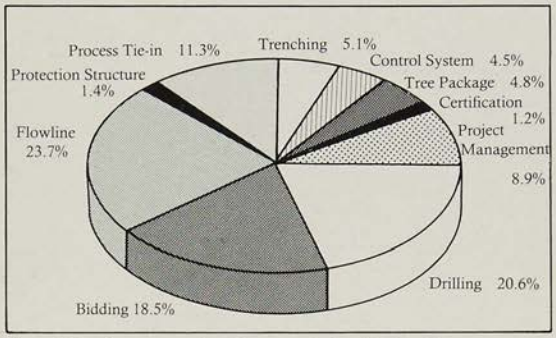


Figure 2: Development cost breakdown — single well, 5km offset

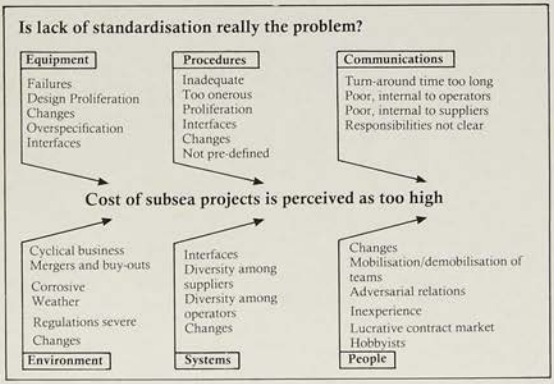


Figure 3

approaches vary widely. Because of the multitude of initiatives, one must ask how much effort has gone into pinpointing the high cost areas of a subsea development programme. Are the initiatives truly aligned towards these areas or have we reached the solutions prior to adequate research and analysis?

Some of the more interesting points to note from **Figure 1** are:

- There are only two initiatives which cross operator boundaries
- The one initiative being driven by the suppliers concerns contract conditions which are controlled by the operators
- Many operators have focused on standardising riser systems. This is not new or unique, EEC (formerly Occidental) implemented this successfully in 1985
- API 17D is a US based and driven specification. The growth markets are generally outside the United States, where API specifications are only generally or partially adhered to.

We must now ask if we are focusing our standardisation efforts in the proper areas and are the active participants in a position to control the standards.

Market segment cost drivers

We must assume, with the amount of focus and attention being paid to standardisation, that the market perception of the industry is that costs are too high. When planning cost reduction exercises, adequate time must be given to changing the way we all conduct our business, eg the process. One-time cost reduction initiatives, or 'quick hits', can look good at first but do not change the business process and can cost more in the long term. One such example of this is the current thinking that supply companies can hold and rent workover risers systems so that the operators do not incur the inventory and maintenance costs of multiple systems. If *all* the operators and suppliers were to take this initiative on and harmonise with the equipment specifications, terms and conditions, maintenance requirements, day rates, etc, we could change the business process. As it stands, we have isolated initiatives which will simply shift the cost burden to another part of the business, not eliminate it.

To understand if we, as an industry, have approached cost reduction in the proper manner, we must first understand where the costs are. **Figure 2** is a

simple illustration of the total costs of a subsea completion, from drilling to completion.

It would appear that programmes focusing on the standardisation of subsea components are not capable of producing the biggest payback. What is probably more important than what the graph tells us is what it does not. This is a subject which a few of the operators are currently promoting relating to subsea standardisation, described as 'the total cost of ownership'. In the author's opinion, this has the most potential for real, long-term cost reductions for the industry. The unfortunate aspect of this is that accurate records of downtime, maintenance costs, equipment failures and remedial actions are scant and are typically not available for public perusal. If this type of information was collated and presented at an industry-wide forum, real progress could be made in attacking the hidden costs to the industry. At present, each project either benefits from, or is penalised by, depending on your perspective, the problems associated with the most recent experience. Both operators and suppliers can contribute a lot in this area.

One of the simplest methods to approach the cost issue is to create a basic cause and effect diagram (**Figure 3**) which breaks down the problem into manageable elements. It can be concluded that principal cost drivers are:

- Interfaces internal to and between operators and suppliers
- Uncontrolled and poorly communicated changes during the project life-cycle
- Proliferation of equipment designs and execution procedures.

Figure 4 depicts the industry's self-proclaimed arch-enemy — proliferation of designs. When questioned, many players within the industry will declare this to be the root of our problems. We disagree; new designs and creative solutions to the problems of our business are the cure, if implemented for the proper reasons. There are a multitude of bad reasons for changing designs, a lot of which can be traced back to poor process control.

The subsea industry is the same as any other business when contemplating product offerings. It is the responsibility of the supplier to provide exactly what the customer wants, when he wants it, at a fair price and fit for service. To bring this philosophy to fruition, however, certain behavioural changes need to take place:

1. Operators and suppliers need to learn how to communicate better.

How does equipment proliferate?

- Field problems cause new approaches for each project
- New innovations by suppliers
- Hobbyists, preference engineering
- Over & under specification
- Lack of design standards within supply companies
- Different operating philosophies, e.g., divers, ROV
- Drilling and/or operations input too late
- Staff turnover
- Updating of standards, e.g., API 17
- Interfaces not specified, constantly change
- 'Standardisation' — short bursts, no commitment

Figure 4

2. Poor product performance must be eliminated.
3. The operators and suppliers should work together to cut costs.
4. The operators should move to functional specifications and take advantage of the arsenal of solutions at their disposal.

Point 4 has already been adopted by some of the operators. When one reflects on the 30 years of design efforts within this industry, it is hard to contemplate that solutions do not exist for 95 percent of all potential developments. To implement a philosophy such as this successfully, an accurate data base of market trends and field failures is required, both of which are fundamental in allowing the suppliers to service the industry.

As a group, perhaps our weakest area is in collating and disseminating failure/malfunction data (and success data) gathered during the installation phase of a project. Information collected in this area is normally only used on the next project, and then only if the project is blessed with continuity of personnel. This is the most critical phase of a project and probably accounts for more than 90 percent of equipment problems. Proper analysis of this data would lead to the identification of failure trends, thus focusing on long-term solutions rather than quick-hit fixes on the following project which often cause another set of problems.

No matter which approach one chooses to pursue, there can be no doubt that further costs can be taken out of this industry. How we do it is up to us. We can continue to shotgun our efforts or we can methodically analyse and solve the real issues driving costs up.

Conclusion

Can we standardise, and if so, where do we focus our efforts? Potential standardisation opportunities are:

- Field development schemes
- Documentation systems
  —Planning, reporting, payment schemes, invoicing, QA
- Offshore operations & service agreements
- Project procedures
- Terms & conditions
- Industry standards & company internal standards
  —ISO 9001, API 6A, API 17D, SI 289, NS 5701, NACE 1638, NPD
- Equipment
  —Drilling, production, installation
- Testing levels & acceptance criteria
  —FAT, extended FAT, integration, shallow water
- Contracting philosophies
  —Large EPC, small EPC, EPIC, purchase order
- Maintenance procedures & agreements

The majority of these areas are system or process related, which have to be the biggest areas of opportunity.

Standardisation thrusts must be controlled and must encompass more than two or three players from within the industry.

Specific recommendations are:

- Focus on total cost of ownership and identify hidden costs
- Focus on product cycle time, bringing product to market quicker
- Higher level of participation in industry forums, especially by top 10 future users
- Publicise and analyse installation problems in industry working groups
- Standardise on the processes which drive our business, such as NF-92
- Adopt the functional specification approach, allowing suppliers to do what they know best
- Make a concerted effort to use existing industry standards without deviation — or, if this is not possible, have them changed.

These actions are not easy and require a broad spectrum 'buy-in' across the industry.

Subsea production is no longer a 'niche' market. It is a business, like many other businesses, which is rapidly approaching maturity. Undertaking the proper cost reduction and standardisation initiatives can help to ensure a positive market outlook. ■

Acknowledgement
This paper was presented at the Offshore Northern Seas Conference in Stavanger in August.

Does viscosity affect oil's cancer-producing potential?

The IP ^{32}P-postlabelling project

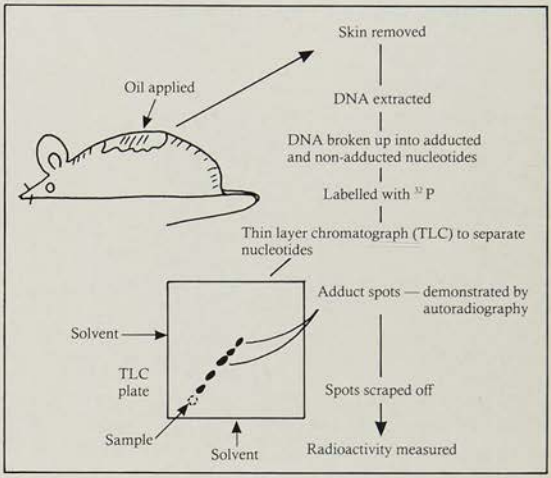
By Dr A J Ingram, BP International

Skin cancer has in the past been connected with the use of poorly refined mineral oils and this has been linked with the presence in the oils of 4–7 polycyclic aromatic hydrocarbons (PCAs). This problem is no longer as great as in the past because of better hygiene and improvements in refining technology. Nevertheless, the link remains and so the Institute of Petroleum decided to fund a research project to investigate whether thicker oils are less likely to produce cancer than their PCA content would suggest.

PCAs present in oils can enter the skin, be activated by enzymes and bind to the genetic material (DNA) of skin cells to form DNA adducts. This is the first stage in a long sequence of events which can eventually lead to skin cancer.

New technique

DNA adduct formation can be detected by a recently developed technique called ^{32}P-postlabelling. In a complicated set of procedures, mouse skin is first treated with oil, DNA is extracted from it and broken up into its basic constituents (nucleotides), some of which will have PCAs attached (adducted nucleotides). The nucleotides are labelled with ^{32}P and applied to a thin layer chromatography plate (tlc plate). This tlc plate is repeatedly washed in two directions with solvents and the materials present migrate in proportion to their molecular size. As adducted nucleotides are bulky, they move slowly and therefore remain as a row of spots along the diagonal of the plate. The position of the spots can be seen by putting x-ray film against the tlc plate so that the radioactivity of the adducts produces spots on the film. The regions of the plate corresponding to the spots are scraped off and the radioactivity measured.



^{32}P-postlabelling method

Effect of oil viscosity

A three-year programme was set up by the IP at the British Industrial Biological Research Association to determine the feasibility of adapting this technique in order to investigate the effects of oil viscosity.

The aims of the programme are:

- To identify the adduct-forming capability of oils
- To see whether the viscosity of the oil is relevant
- To determine if this data could be used for classifying oils with respect to their cancer-producing potential.

Progress

During the first year, the ^{32}P-postlabelling technique was successfully developed, using a model carcinogen which was tested on three oils for which long-term skin painting data were available from previous studies. These tests showed that adducts were formed with two oils which had produced skin cancer in long-term studies, while no adducts were formed with one oil which had not produced cancer in long-term studies. It was observed that the adduct pattern (on the x-ray plate) varied for the two carcinogenic oils, implying that different constituents may be contributing to their carcinogenic potential.

The second year of the project, currently being undertaken, is yielding fundamental information. Research is now concentrating on the identification of the components of oils capable of causing adducts to be formed.

Extracts from oils have been prepared by two separation methods — dimethylsulphoxide extraction using the IP346 method and a more precise separation of oils into saturated hydrocarbons (mainly paraffins), aromatic hydrocarbons (containing PCAs) and polar compounds (nitrogen and sulphur compounds etc). These fractions from the three oils — which had already been examined as whole oils — were tested separately for adduct-forming potential.

The more precise separation of oils into saturated, aromatic and polar fractions yielded the clearest results with, as expected, no activity in the saturated fraction of any oils and clear adduct-forming activity in the aromatic fraction of the carcinogenic oils. However, it was discovered that the polar fraction of one of the carcinogenic oils also showed some activity, with an adduct pattern different from that seen with the aromatic fraction.

This result was new information that unsubstituted PCAs may not be solely responsible for the carcinogenicity of all oil products.

Future studies

Further examination of aromatic fractions of commercial oils is planned and hopefully this will result in more new information. In the past it had been assumed that skin cancer-producing potential was only present in those PCAs having four or more rings.

Once the adduct-forming fractions have all been identified, they will be tested in a low viscosity oil for comparison with the results of the original whole oil. This will enable the effect of oil viscosity to be studied.

In the meantime some practical difficulties in quantification have arisen. These problems will be considered during the third year of the project when further commercial oils of varying viscosities will be studied, both as whole oils and as fractions. Some refinement to the methodology will also be necessary.

Conclusion

Oil fractions which have cancer-forming potential have been largely identified and considerable new information obtained.

There is every indication that the project will fulfil its original aims and that, in addition, valuable fundamental information on oil carcinogenicity will be generated.

It is important to capitalise on this new initiative by planning more wide-ranging research to follow these preliminary studies. ■

Turkmenistan offers producing fields

The goverment of Turkmenistan has announced that it will offer for competitive bidding four blocks containing producing and non-producing fields in the first of several planned rounds. The blocks lie in the west of the country bordering the Caspian Sea — in what has been described as a 'highly prospective' area.

Statistics show that production at most of the older fields in western Turkmenistan went into decline during the late 1970s. Almost every well, after initial high producing rates, subsequently showed a decline. This reflects the severe curtailment in the supplies and equipment needed to develop and maintain properly the producing fields in this region. Initially the cause was non-allocation of scarce resources by the central USSR petroleum ministries; more recently it has been the lack of financial resources locally.

In the past official proven reserves have been lowered to take account of the availability and supply of technology. To correct this apparent underestimation of reserves, certain adjustments have now been made.

The proven undeveloped reserves (PUD) in Block I have been increased by 50 percent for oil and reduced by 18 percent for gas. The oil increase accounts for expected south flank reserves not credited earlier and the gas decrease accounts for postponement of significant gas cap production until after 25 years.

The proven developed reserves in Blocks II and III remain the same but production has been accelerated to realise full recovery in 25 years. Proven oil reserves in Block IV have been increased by more than 200 percent to account for recently discovered new producing horizons and a larger productive area.

The 'Adjusted Proven' remaining reserves in each of the four blocks being offered for competitive bidding on 20 December are in the order of 230–642 million barrels of oil and 0.89–2.2 trillion cubic feet of gas — though it is understood that actual figures may well prove to be higher still.

There are basically three export routes from Turkmenistan: Russia to the north, the Black Sea to the west and Iran to the south. The Russian option implies overland outlets in Russia, Eastern and Western Europe. The Black Sea implies marine outlets in Turkey and Europe, while the Iran option implies overland outlets to Iran and Turkey as well as export access through the Gulf.

Some of the export routes are currently in existence; some are being studied (see *Petroleum Review*, July 1992).

Support for the development of export routes comes from the optimistic expectation that Turkmenistan resources could be of Middle East scale — of the order of 200–250 billion barrels of oil equivalent.

Contract is 50–50 joint venture and terms vary according to block. Award is based on bonus which is tax deductible. Taxes are 35 percent on profits only, guaranteed by government against adverse changes. Effective control of the joint venture rests with the foreign party and the terms are 25 years with a possible 10 year extension. Minimum work requirements and sliding royalties vary with each block. Further details are available from WaveTech Geophysical Inc of Denver.

Despite concern at the political upheaval in the former republics of the Soviet Union, the venture is claimed to be low risk by international standards. Technically, very large reserves are probable and the risk of failure to bring production levels up to good commercial rates is quite low.

Contract is guaranteed against adverse tax treatment by the Turkmenistan government which is reportedly one of the most stable governments of the former Soviet Union.

Expansion of the oil and gas trade is one of Turkmenistan's highest priorities and joint enterprise operations will have maximum government support and backing. ■

'ADJUSTED PROVEN' REMAINING RESERVES

Category	Oil (MMB)	Gas (TCF)
BLOCK I (PUD +)	454	2.2
BLOCK II (PDP acc)	230	1.87
BLOCK III (PDP acc)	642	2.16
BLOCK IV (PDP +)	230	0.89

Microbiological contamination of distillate fuels

There is currently a high incidence of microbiological contamination of distillate fuels which is causing some concern to the European trading community. The pattern of contamination does not appear to be limited to any one particular source but would seem to be coming from certain strategic stocks of fuel oils that are being run down. The dramatic escalation of this problem, evident in the sudden surge in samples for analysis, is a matter of some concern to the trading community, in view of the possibility of expensive claims for treatment and restoration of contaminated stock and facilities and the risk that this contamination might spread through the storage and distribution system.

The first of a series of advisory seminars for microbiologists, traders and others was organised last month by SGS Redwood.

The IP Microbiology Committee intends to consider the general problem and the issues arising from the current crisis at a short workshop, 'Current Problems of Microbial Spoilage of Bulk Distillate Fuels', on 3 December. At this workshop there will be a review of the current problems, a discussion of tests standards and fitness for use and some indication of treatment options.

The Institute looks to the future

The Institute of Petroleum's Mission, Objectives and Strategy, otherwise known as MOS, is the result of a review undertaken by IP Director General Ian Ward and members of the Management Committee. This has now been approved and published.

Lord Cadman of Silverdale in whose memory Mr Lo van Wachem, Chairman of the Supervisory Board of Royal Dutch Petroleum Company, gave the 14th Cadman Memorial Lecture on 14 September (see page 483), would have approved of the process. It was Lord Cadman, then Sir John Cadman, who called a private meeting of Council and senior staff during his second presidency from 1935–37 for a 'frank discussion on the future of the Institute'. This led to a process of change from which evolved the organisation, constitution and name of the Institute of Petroleum as it is today. The past 55 years are a testimony to that foresight.

As in the 1930s, the world of the oil and gas industry is changing significantly. We all now face new and challenging circumstances, with the ever-increasing influence of Europe, the constant importance of safety against a background of technological change and the development of environmental issues into a mainstream political concern. It was clearly time to look again at the Institute's aims and objectives.

The Director General met each member of the Management Committee to hear their individual views and perceptions of the role of the Institute in the 1990s and beyond — its strengths, weaknesses, opportunities and threats. Then, through an interactive process between the Management Committee Branches and senior IP staff, a statement on the Institute's Mission, Objectives and Strategy was prepared and subsequently endorsed by Council.

MOS will now provide a directional framework for both the Institute's staff and the members of all IP Committees and Discussion Groups, for taking the Institute forward into the next century. This will be the standard against which to measure any new proposal. If a project does not fit with MOS, then it is unlikely to be pursued.

The Mission is:

> To be the most respected independent European-based centre for the advancement of technical knowledge relating to the international oil and gas industry.

The Mission is enshrined in five broad Objectives:

INDEPENDENCE
To preserve an industry focus independent of government and commercial interest.

MEMBERSHIP
To increase the Institute's membership, maintaining diversity and expanding international representation.

TECHNICAL
To secure the international recognition of the Institute's Codes and Standards.

RESEARCH
To manage research programmes in those areas of common interest to members.

FORUM
To provide a focal point for interaction between all interested in the oil and gas industry.

The 10 Strategies which set the broad course of action to meet the objectives cover finance, membership focus and service, external relations, research, reputation, communications, Europe, education liaison, human resources and information technology. **Copies of the MOS booklet can be obtained from Mrs Pauline Ashby, The Institute of Petroleum, 61 New Cavendish Street, London, W1M 8AR.**

Piper Bravo: safer by design

By Gulab J Rijhwani,
Senior Safety Engineer,
Elf Enterprise
Caledonia

The design and construction of Piper 'B' has taken over three years. During this period considerable effort and resources have been invested by Elf Enterprise and partners — Texaco, Union Texas and Lasmo — in an attempt to make the Piper 'B' as safe as reasonably practicable.

Risks are always present whenever and wherever facilities are installed and operated for the exploitation of hydrocarbons. The risk to personnel involved in this work is magnified on an offshore installation by the proximity to potential hazards and the difficulty of evacuation during an incident.

It was decided at an early stage in the field development plan to take all necessary steps to make this risk as low as reasonably practicable, a principle subsequently expounded in the Cullen inquiry report. In planning the Piper field redevelopment, the company made a conscious decision to develop the safest platform in the North Sea.

Safety management

This commitment has proved to be a challenging task which has exercised the minds of all people involved in the design. It was not sufficient to design to meet existing or foreseeable safety legislation. It had to be determined at each stage that maximum practicable standards of safety had actually been incorporated in the design.

To achieve this, Elf Enterprise operates a system of safety management and assessment. The development has gone through an evolutionary process and been subjected to qualitative and quantitative evaluation at each stage. To ensure that each development option was considered in an objective manner, a project safety plan was established. The core of this is the safety acceptance criteria.

These criteria are intended to provide a viable means of protecting personnel in the event of a catastrophic incident and to ensure that the risk to individuals is minimised. This has required an integrated approach and

all aspects of design have been subjected to regular assessment to ensure the highest levels of safety.

Platform layout

One of the key safety features of Piper B platform is its layout. Maximum possible physical separation has been provided by placing the utilities module between the hazardous areas of the platform and the accommodation and control areas.

The accommodation and control areas form part of the Temporary Safe Refuge (TSR) and are segregated from the utility module by a blast and fire resistant bulkhead.

The TSR is visualised not just as a protected box which will survive for a specified period (in this case two hours) under the most adverse conditions. It has been developed as a system which has not only physical boundaries but also incorporates facilities which make it viable as a shelter and from which the crew can be evacuated, with minimum risk, should the need arise.

A fire and blast analysis study was carried out to identify the partitions which would be exposed to thermal and pressure loads in the event of a fire or explosion. As a result of this fire resistant coatings have been applied to all critical structural members and blast resistant barriers provided, with the consequence that the platform structural integrity will be maintained for at least two hours without reliance on active systems. Three blast walls separate the hazardous wellhead/drilling, process and compression module from each other and from the non-hazardous utilities module.

During the development of the layout emphasis was placed on ensuring the viability of escape routes following any predictable event. An enclosed muster area has been provided as an integral part of the TSR. Six survival craft are also incorporated within the TSR. This will make Piper B the first platform where embarkation can take place from within the TSR, without exposure to a hostile outside environment.

The possibility, however remote, has been considered that all escape routes to the TSR may be blocked, thus isolating personnel in the process areas of the platform. An Auxiliary Emergency Centre (AEC) has been provided to which personnel who cannot reach the TSR can withdraw and remain in safety. Escape craft have also been provided at this end of the platform to enable evacuation of the personnel who may have sheltered in the AEC.

Piper B is equipped with free-fall lifeboats for personnel evacuation. This will make it the first production platform in the UK sector of the North Sea to have this type of craft as part of its original design.

The lifeboats can be launched with the engines running. They are oriented so that the momentum of the launch tends to take them away from the platform. The boats are fitted with an integral deluge system for protection against sea surface fire. Tests have shown that the boats can withstand an external temperature of 1,000°C while the average internal temperature remained at 30°C.

Active protection

Sea water is the primary active fire protection medium on the Piper B platform and is delivered through a variety of equipment, both installed and manual. Deluge systems are provided for the protection of the process areas. Aqueous Film Forming Foam (AFFF) agent is injected into these systems to achieve rapid fire control.

The system is served by four 50 percent duty pumps. The pumps are driven by diesel engine prime movers and are therefore completely independent of the platform power supplies.

Two of the pumps are installed in the utility module and two in the wellhead module at the opposite end of the platform. The locations selected ensure the greatest separation between pumps thus minimising the possibility that any single event will affect the availability of the system.

Halon 1301 systems have been installed for the protection of critical key equipment areas. In recognition of its adverse environmental effect, the decision to use halon was only made after all possible alternatives had proved impractical. Halon usage has however been minimised following a critical review.

Piper B has an extensive fire and gas detection system. Detectors have been chosen with a view to enhancing reliability.

A major effort was made in the selection and location of gas detectors. Piper employs both thermocatalytic and infra-red combustible gas detectors. The latter have been used in external areas to provide early indication of gas migration.

A high reliability control fault tolerant control system further enhances the system operability. This employs a triplicated microprocessor logic with automatic diagnostic functions.

Control

Piper B is equipped with a sophisticated process control system whereby all process functions can be monitored and controlled from the control room. The system has built in redundancy and diagnostic supervisory systems.

Rotating equipment can be shut down remotely. Once this has been done the equipment cannot be restarted without receipt of a coded signal from the control room.

From the main control room dual redundant cable systems run through separate routes to provide true control of platform operations.

A combined Emergency Shut Down (ESD) and Blowdown system which operates automatically under prescribed conditions has been provided. The Blowdown system has been sized to permit the simultaneous depressuring of the complete process train.

Piper B is the first new platform in the UK sector of the North Sea which has subsea isolation valves on all hydrocarbon import and export lines. These are designed to protect the platform from the hydrocarbon inventory in the pipelines. Furthermore, each riser is separated so that an incident at one will not affect another.

Conclusion

The operations group has been an integrated part of the design task force since the inception of the project. This practical hands-on experience has been invaluable in identifying potential problem areas and maximising operator safety.

Production is scheduled to start in the last quarter of this year. ■

Award of the Cadman Medal

'The three-cornered challenge — energy, environment and population'

LC van Wachem, chairman of the Supervisory Board of the Royal Dutch Petroleum Company, received the Cadman Memorial Medal from IP President, Charles Smith, on 14 September. Prior to the award ceremony, Lo van Wachem gave the Institute of Petroleum 1992 Cadman Memorial Lecture to a distinguished gathering of oil industry executives, representatives from government, the diplomatic corps and the press at the Institute of Directors in London.

Mr van Wachem's address concentrated on three main issues — the world's increasing demand for energy, the growth of the world population and the need to safeguard the environment as well as the interrelated links between them. He admitted that this challenge was a difficult one but he was optimistic, believing that with the careful use of resources and the application of science and technology, the current generation would learn eventually to balance the needs of the world's population with the needs of the earth.

The lecture was followed by a celebratory dinner, held in the Waterloo Room at the Institute of Directors. Among those present were three previous recipients of the prestigious Cadman Medal — Sir Peter Baxendell, Sir Eric Drake and Sir Peter Walters.

Mr van Wachem said:

I am honoured to be here and to join the small group of people who have been invited to give the Cadman Memorial Lecture and to receive the Cadman Medal.

It can be said of all those who have received this honour before me that they made a significant contribution to the oil industry. To be viewed in the same light by my peers is an accolade indeed, especially since this lecture and award commemorate one of the giants of the oil business. The first Lord Cadman bestrode the worlds of academia, business and politics, at a time of widespread political upheaval and in the burgeoning days of the international oil industry. In the late 1920s, at the peak of his influence, he operated on the same plane as Deterding and Teagle, but also with unparalleled credibility in the eyes of the British government. His was an outstanding career, by any reckoning, and I am proud to be among such as Lord Godber, Sir Eric Drake, Sir Peter Baxendell and Sir Peter Walters, my Cadman Medal Award predecessors, in perpetuating his name.

On such an occasion as this, when one is being honoured for past efforts and when, like me, one has just 'retired' to some extent from frontline activity, it is tempting to review one's own history a little, at least as far as it coincides with the history of the oil industry.

However, I shall resist the temptation. My preference is to look forward rather than back, to what I would term the three-cornered challenge which faces us today and will continue to face us in the next few decades.

I am talking of the challenge posed by inextricably linked issues — the world's increasing demand for energy, the growth of world population and the need to safeguard a viable world for future generations. The growing populations of the developing countries seek to expand their economies to achieve the standards of living we in the developed world already enjoy, which will call for increasing consumption of energy, however advanced the technology deployed. At the same time, there is growing concern, expressed most forcefully in the developed world, about the environmental degradation which has been associated with industrial development in the past and a determination to raise the environmental standards to which industry operates. This is only achievable in the context of expanding economies and, in many cases, will, in itself, call for increased energy consumption. There are not the resources to do everything at once and the challenge to all of us, in all sectors of society, is to establish a sustainable pattern of growth which will meet the legitimate aspirations of all.

I make no apologies if some of my remarks may sound familiar. I am not alone in having spoken before on such issues but I believe strongly that this three-cornered challenge is the most important one facing the world, and it has serious implications for energy businesses. That is why I come back to it today.

Energy demand

Let me start with energy, the subject which links us all with Lord Cadman. It is widely known that in Shell we set much store by scenario planning. Scen-

arios are not forecasts but views of different futures, each internally consistent, against which we test the robustness of our business plans. We are currently preparing new scenarios in which the principal factors which affect our industry will be examined: you will not be surprised that the themes of geopolitics, economics and the environment figure largely.

They will take into account the dramatic events which we have seen on the world stage in the last two or three years — events which suggest that our past estimates for the growth of world energy demand may have been too conservative. Almost simultaneously, we have seen tremendous economic and policy changes in eastern Europe and Latin America, with significant implications for energy demand. With these changes has come a fundamental shake-up in the political and economic certainties we have accepted for so long. Now there is the possibility of a radically different sort of world, with new hopes and fears. What happens, or does not happen, in the developing world is of the greatest importance. Concerted global efforts to resolve worldwide problems may now be more feasible.

As the developing world strives to meet the needs of its people, to industrialise or develop an industrial base and to create market economies, the impact on energy demand may be even greater and sustained over a longer period of time than hitherto thought.

Imagine the impact on demand if China and India, which together account for some 40 percent of the world's population, begin to show the economic growth rates that have transformed the Asian newly industrialised countries. If levels of car ownership in China were to reach those of the United Kingdom today, another 430 million cars would have to be manufactured and fuelled — which is about the entire car population of the world today!

Developments on this scale would present a significant challenge to the energy industries to meet the increase in demand efficiently, safely and cost-effectively. There is no question that we will need all the world's current sources of commercial energy to meet demand now, and in the near future. In 1991 world primary energy demand was around 168 million barrels per day of oil equivalent; oil and gas made up around 60 percent of this and coal another quarter. Nuclear energy and hydropower were, of course, significant sources of electricity but wind, solar and biomass energy remained small.

For the next quarter of a century, we will have to rely on these existing sources of energy. This is simply because of the huge scale of energy facilities and plants and their very long lives and construction lead times. There will be some shifts in the pattern of use driven by environmental concerns — notably an increased dependence on natural gas rather than coal and oil. But essentially the fossil fuels will continue to dominate energy supply for many years yet, and the degree of freedom to choose between them will be limited, particularly over the next decade.

In any event, growth in energy demand, it seems to me, is almost a prerequisite of achieving sustainable development. To quote a recent combined statement by The Royal Society of London and the US National Academy of Sciences: 'Sustainable development implies a future in which life is improved worldwide through economic development, where local environments and the biosphere are protected and science is mobilised to

create new opportunities for human progress'.

For myself, I cannot think of a means of bringing about global economic development that does not involve the increased use of energy.

Energy is required to grow the food that people eat and to provide them with light and cooking facilities. In the first stages of development, populations move from depending on firewood to commercial fuels such as kerosene or liquid petroleum gas. Then, as societies develop, the growth of manufacturing industry and energy consumption go hand in hand.

It is only this increased economic development that provides the resources to protect local and global environments and to fund scientific advances that bring new opportunities for progress. And we must not forget that the pressing environmental problems of very poor people are things we take for granted — clean drinking water and proper sanitation. If you ask anybody who has visited Calcutta, for example, if they would support the view that the city was in urgent need of a modern sewerage system, you would find enthusiastic support; but there are some who would show less willingness to accept the energy cost of building and running it.

It may be that no demands to improve the condition of even the poorest communities justify the profligate or unwarranted use of energy. But we have to accept that, if economic growth is a significant ingredient of sustainable development, then so too is energy.

Environmental impact

Herein lies the dilemma. We accept that growth is required, both to meet the natural aspirations of the people of developing countries and to provide the impetus that is needed to achieve sustainable development. And we recognise that achieving that growth will require the consumption of greater quantities of energy. Yet the generation of energy, particularly from the burning of fossil fuels, presents inherent environmental problems.

If the greater use of hydrocarbon fuels in large parts of the world is inevitable, that will, of course, mean increased production of carbon dioxide — an important contributor to the greenhouse effect. Today, burning fossil fuels results in the emission of between five and five and a half gigatonnes per annum of carbon as carbon dioxide, split about equally between OECD (Organisation of Economic Co-operation and Development) and non-OECD countries. If we look ahead to 2020, it is easy to foresee that the non-OECD countries alone could account for that quantity. The OECD countries might expect to hold emissions at about today's level so a 50 percent increase is quite on the cards.

Mr van Wachem and Sir Peter Baxendell (R), a former Shell colleague who reminisced about their times together in many corners of the world, when he spoke after the dinner.

There is strong support in the political world for the view that man-made emissions are likely to augment the greenhouse effect and lead to some degree of global warming. But there is still debate among authoritative individuals and groups about the basic science and how significant the effect might be in different areas of the world. Neither is there clear consensus about the most appropriate proposals to counter global warming — as is clear from the discussions that took place at the Rio Earth Summit and in the reaction to the European Community's proposals for a carbon/energy tax.

Nonetheless, practical precautionary measures to ameliorate the position are being taken and should be encouraged, particularly where they also have other beneficial effects. A clear example is improving energy efficiency in the developed world and exporting that technology to developing countries. Another beneficial factor could be a switch to natural gas — with its lower carbon content — for power generation but even that cannot be done overnight. Other possible policies include encouraging nuclear power but this has its own set of problems. Some renewable energy technologies look promising but will take some time to become competitive and even longer to contribute a significant share of world energy demand. As I said earlier, we will need to make the most effective possible use of all these sources of energy in the coming years.

But the carbon dioxide is only part of the dilemma we face in meeting the world's growing energy needs. Burning fossil fuels also generates pollutants such as nitrogen oxides and sulphur dioxide, which contribute to urban air pollution and acid rain. These have to be treated separately, and the actions which minimise them are often at the expense of increasing carbon dioxide emissions. The classic example is the move towards low sulphur diesel, where for every tonne of sulphur removed in the refinery an additional 20 tonnes of carbon dioxide is released into the atmosphere.

As with so many areas of conflict, the question is one of balance. There is much that we in the energy industries can do — and are doing — both in cleaning up our own acts and in making our knowledge available to others. But finding the right balance between challenges and solutions is not just a requirement of the energy industries, or even industry generally. Many environmental problems have a global dimension and demand global answers. They are too big to be solved by one sector of industry, one nation or even one region. All the stakeholders must shoulder the responsibility of ensuring that the future is a fit one for the generations to come.

Industry generally has a responsibility to co-operate with others in society, most notably governments, to seek desired solutions to environmental problems.

But, in the final analysis, decisions must reflect the collective will of people expressed through their governments. The duty of industry in the interests of society at large is to ensure that these

decisions are based on a correct understanding of the relevant facts.

I believe one responsibility of governments is to establish level playing fields, not through restrictions that hamper industry's innovation or discourage voluntary commitment, but through a market-based approach to legislation that makes the best use of industry's strengths and enterprise. Governments must debate with industry and others the strategies and options available; when consensus is realised they should set clear guidelines that are not constantly changed. In particular, government intervention in the process of change, either nationally or internationally, should not distort competitive forces. In a market economy, industry's ability to finance programmes to reduce its environmental impact depends on its continuing to make a profit. Companies should take the lead when they can; but, on the other hand they should not be expected to gamble reputation or assets where they may be exposed to unreasonable or unpredictable penalties — I have in mind, for example, the penal risks now associated with marine operations in United States waters.

Regardless of the problem of governments in achieving consensus, I believe we in the energy industries have a prime responsibility to minimise the environmental impact of our activities by continuing to pursue excellence in our environmental performance. For many years, we have accepted and acted on that responsibility and, despite setbacks and accidents, huge strides have been made.

But whatever progress we make seems to be outpaced by the increasing skills of the analytical chemist. Twenty years ago scientists measured trace contaminants in parts per million: now, with the aid of improved analytical techniques, coupled with advances in computer power, they can track contaminants in parts per billion. The European Commission, for example, requires that the amount of individual pesticides in drinking water is no higher than one-tenth of a microgram per litre. Ten years ago, it was a challenge to measure such a small contamination. These days, a millionth of a microgram, or one picogram, of certain pesticides can be detected in a litre of drinking water. All too often these striking advances in analytical technology are announced as if they represented the discovery of a new hazard to our lives resulting from industrial pollution. We might almost borrow an acronym from the computer world — WYSIWYG — what you see is what you've got!

Remarkable progress has been made in cleaning up some forms of air pollution in many parts of the world. Last year the OECD report, *State of the Environment*, said that concentrations of sulphur dioxide in urban areas had decreased by 30 to 75 percent in OECD countries over the previous 15 to 20 years.

In our own industry, emissions of lead and sulphur from products have been reduced. Flue gas desulphurisation units installed in coal-fired plants can effectively reduce sulphur dioxide emissions into the atmosphere. Advanced gas scrubbers can remove about 90 percent of the sulphur dioxide and can also be designed to reduce emissions of nitrogen oxides at the same time. Technical improvements to boiler and burner designs have made it possible to reduce emissions of nitrogen oxides to meet stringent regulations in Europe and the United States.

A number of clean coal technologies are now also available, the most promising of which first gasify the coal, then clean the gas and use it to fire gas turbines. Other more advanced technologies, still at the earliest stages of development, may enable us to use more cleanly the world's vast reserves of coal.

Energy efficiency

The technical potential for increasing energy efficiency is high. For example, simply replacing incandescent light bulbs with compact fluorescent bulbs reduces electricity consumption, while labour costs are also cut because they last five times as long. Harnessing waste heat from a power station to heat homes cuts central heating bills and increases the efficiency of the power station. The average new car in the United States in 1990 does 28 miles to the gallon, compared with 23 in 1980.

It is exceedingly difficult to estimate how much the application of technical potential can reduce energy demand in practice but studies in the United States have come up with reductions in energy use of an impressive 20 percent even at the conservative end of the scale.

Annual evaluation of the energy balances in Shell refineries has shown that efficiency has doubled over the last 30 years, and upgrading of equipment and improved product quality continues to boost environmental performance. In the chemicals industry, the energy required to manufacture polypropylene fell by 46 percent over the nine years to 1991.

These and other measures now available to minimise the environmental impact of burning fossil fuels while maintaining industry are the direct result of human ingenuity. As an engineer, I should perhaps be optimistic enough to believe that a technical solution will be found to nearly every environmental problem. I am pleased to see that I am in distinguished company in this view.

Back in June, the 'Heidelberg Appeal' by nearly 300 eminent scientists, including 52 Nobel Prize winners, stated that: 'The greatest evils which stalk our Earth are ignorance and oppression, and not Science, Technology and Industry, whose instruments, when adequately managed, are indispensable tools of a future shaped by Humanity, by itself and for itself, overcoming major problems like overpopulation, starvation and worldwide diseases.'

The appeal touches on a curious

Mr Chris Fay (L), Managing Director, Shell Expro and Mr van Wachem

anomaly of our times. Nearly a year ago, during an address at Yale University, I commented briefly on the difference between 18th century and 20th century attitudes to science. The 18th century was fascinated with things scientific, just when the world was beginning to be turned on its heels by technology; yet few ordinary people had really benefited from technological achievement. By contrast, there are many in the 20th century who seem to hold a marked aversion to science and a resistance to the deployment of technology, while benefiting to the full from the advantages that scientific knowledge brings.

Anyone who seeks to live in a world that does not depend on science and technology might do well to heed those eminent signatories to the Heidelberg Appeal who contend that a 'natural state' does not exist and probably has never existed since homo sapiens first appeared on earth and began to use the world's resources to meet his needs.

However, the dilemma remains that while we have made great strides in applying science and technology to finding solutions to environmental problems, the solutions themselves involve greater use of energy. And if such is the case with some anti-pollution measures, judgements have to be made about where the balance of benefit lies.

Population growth

While these issues of environmental degradation and global warming are serious threats to our goal of sustainable development, at least as serious an obstacle is population growth. In fact, in terms of the growing energy needs of the developing countries, they are inextricably linked.

In some industrialised countries, birth rates are falling below the level needed to maintain their populations. And even though annual growth rates are falling, the world's population is growing by nearly a quarter of a million each day. Last year, the United Nations Population Fund stated that population growth was then even faster than its 1984 forecast. The UN current mid-range projection is that population will rise from 5.4 billion in 1991 to 10 billion in 2050. But that depends on fertility rates stabilising at replacement levels. And all but five percent of those extra people will be residents of the developing or less developed countries, contributing to the growth of their energy requirements.

As business people yourselves, you will appreicate that I find it difficult to comment on population growth rates. It is not for me to explore the ethical or religious aspects of the issue, particularly on this occasion. That is best left to moralists and churchmen. However, I have lived for much of my life in countries at a stage of rapid population growth, and so I have seen at first-hand some of the difficulties that can arise as a result, both economically and environmentally.

It often seems to me that those who live in developing countries have less opportunity to contribute to the debate than some of the more vociferous elements of the developed world. I vividly recall being asked by the president of one developing country to explain to my fellow Europeans that, for him and for his fellow citizens, the environment did not just consist of plants and animals, but of men, women and children too.

We should all be quite clear in our minds that the men, women and children in the developing world will strive to achieve the living standards of their choice, just as those of us who live in the developed countries have done. And, of course, they have every right to do so. I also believe that what they will seek is something similar to what we have.

They will, at the very least, seek clean water, sanitation, reliable electrical power for light and heat, and consistent fuel supplies for cooking. They will want roads and communications. They will want the opportunities that education brings. They will want jobs. And they will want leisure activities, CDs, microwaves and dishwashers, plus the time and money with which to enjoy them.

Try as I might, I cannot see any way in which these needs and wants can be met without using more commercial energy. And that, of course, has its implications for the concept of sustainable development.

Need for balance

If we are not to jeopardise the possibility of sustainable development, then the world as a whole must find ways to manage the effects of the extra demands that the growing numbers of people will place on the earth's resources.

How can this be done? Staying with population growth for the moment, the decline in birth rates in Latin America and Asia over the past three decades has shown a good correlation with socio-economic development. Plainly, as wealth increases, there is no longer such a need in some cultures to protect one's future through the security of large families. Economic growth, in turn, is facilitated by education and one can certainly understand how increased education, particularly among women, combined with reductions in infant mortality rates, would contribute to slower population growth.

What is harder to see is how these influences on population can be effected at other than the level of the individual in his or her own country. Resolutions taken at assemblies around the world will probably change the situation very little. What I believe will make a substantial difference is a massive programme of education appropriate to the overall needs of each country.

Of course, there are other measures that can be taken to ease present problems and encourage progression to our goal of sustainable development. I would include among them an acceptance that together and separately we will have to take difficult and sometimes unpopular decisions. I believe that we must view the earth as one entity and accept, for example, that higher production of, say, greenhouse gases in some areas, can be partly offset by lower emissions elsehere. This will put pressure on the developed world to use its energy more efficiently and to ensure that its technology helps the rest of the world use energy just as efficiently.

Also high on my sustainable development list would be the need for industry to continue to play its role in wealth generation. I have said before and feel no shame in repeating that only growing economies can provide the resources to meet people's aspirations and need for jobs. Only strong economies can turn sustainable development from a concept in our minds into reality for our children.

The three-cornered challenge is a difficult one. But I don't see the future as gloomy, despite the dark warnings of the doomsayers. I believe that, with commitment from all the stakeholders in the environmental debate, and that surely means every person alive on this earth, with the careful use of resources and the appropriate application of our science and technology, we will learn eventually to balance the needs of the world's population with the needs of the earth. It will not be an easy task, and many of you will be engaged in it far longer than I. But I believe you are more than a match for the task — and I wish you well. ■

FORTHCOMING EVENTS

October

6th–8th
London :'Interspill '92'. Details: Xponent Ltd, The Courtyard, 98 High Street, Bedford MK40 1NN. Tel: (0234) 212988. Fax: (0234) 271157.

7th
London: Seminar on 'An oil company's balance sheet'. Details: Mrs P Ashby, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Tel: (071) 636 1004. Fax: (071) 255 1472.

7th–8th
Kinross: Course on 'Selling the Virtues of Oil'. Details: Petroleum Training Federation, Room 326, 162–168 Regent Street, London W1R 5TB. Tel: (071) 287 5483.

7th–8th
Aberdeen: Conference on 'Advances in Solving Oilfield Scaling Problems'. Details: Sarah Peace, IBC Technical Services Ltd, Gilmoora House, 57–61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

8th
London: Conference on 'Exploration, Appraisal and Development Farm-ins and Swaps'. Details: Langham Oil Conferences Ltd, 37 Main Street, Queniborough, Leicester LE7 3DB.

8th–9th
Oslo: Conference on 'Floating Production Systems'. Details: Conference Officer, OCS, 34–36 Apsley End Road, Shillington, Hitchin, Herts SG5 3LX. Tel: (0462) 712049. Fax: (0462) 711889.

8th–9th
London: Conference on 'Assessing your opportunities in the developing UK gas market'. Details: IIR Industrial Ltd, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: (071) 412 0141. Fax: (071) 412 0145.

9th
Teddington, Middlesex: Open day at the National Weights and Measures Laboratory. Details: National Weights and Measures Laboratory, Stanton Avenue, Teddington, Middlesex TW11 0JZ. Tel: (081) 943 7272. Fax: (081) 943 7270.

12th–16th
Rome: 'Energy, Environment and Technological Innovation'. Details: Studio EGA, Viale Tiziano, 19 — 00196 Rome, Italy. Tel: 39 6 3221806. Fax: 39 6 3222006.

13th
London: Conference on 'Natural Gas Vehicles — The way ahead to a cleaner environment'. Details: David Suthers, Director, The Combustion Engineering Association, PO Box 15, Farm Road, Aberaman, Aberdare, Mid Glamorgan CF88 6YZ. Tel & Fax: (0685) 879119/874201.

13th–15th
Manchester: Course on 'Incineration Technology: Equipment Selection and Operation'. Details: Liz Hide, IBC Technical Services Ltd, Gilmoora House, 57–61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

13th–16th
Aberdeen: 'International Offshore Contracting and Subsea Engineering Exhibition and Conference'. Details: Spearhead Exhibitions Ltd, Rowe House, 55–59 Fife Road, Kingston upon Thames, Surrey KT1 1TA. Tel: (081) 549 5831. Fax: (081) 541 5657.

14th–16th
Athens: Conference on 'Natural Gas Policies and Technologies Part II: Technologies'. Details: LDK Consultants, 7, Sp. Triantafyllou Str, GR 113 61 Athens. Tel: 30 1 8629660. Fax: 30 1 8617681.

15th
London: 'UK Coat '92'. Details: Institute of Energy Conferences Department, 18 Devonshire Street, London W1N 2AU. Tel: (071) 580 0008. Fax: (071) 580 4420.

15th–16th
Lisbon, Portugal: 'First European Oil and Gas EDI Group Conference'. Details: Tessa Berry, Bellatrix Associates, Brooke House, Market Square, Aylesbury, Bucks HP20 1SN. Tel: (0296) 89911. Fax: (0296) 641726.

15th–20th
Perm/Ural: Trade Fair 'Energy and Ecology 92'. Details: Glahe International KG, Herler Strase 103, D-5000 Koln 80, Germany. Tel: 0221 62 43 00. Fax: 0221 62 56 90.

18th–27th November
Moreton-in-Marsh: 'International Fire Prevention'. Details: The International Courses Office, The Fire Service College, Moreton-in-Marsh, Gloucestershire GL56 0RH. Tel: (0608) 50831. Fax: (0608) 51788.

18th–23rd
Rio de Janeiro, Brazil: Rio Oil and Gas Expo '92, and 5th Brazilian Petrochemical Congress'. Details: Goal Promocoes E Feiras, Rua Conde de Lages, 44 -s/1301, CEP 20241, Rio de Janeiro, Brasil. Tel: 55 21 221 8086. Fax: 55 21 221 3804.

20th
London: Conference on 'Business Information Services in the Oil Industry — Working for Success'. Details: Miss C Little, The Institute of Petroleum.

20th–22nd
Manchester: Symposium and exhibition on 'Major Hazards Onshore and Offshore'. Details: T. Thompson, Symposium Organiser, 7 The Serpentine, Liverpool L19 9DT. Tel: (051) 427 1596.

20th–22nd
Antwerp: 'Tank Europe 92'. Details: Mr P. Payne, Conference Co-ordinator, Baltic Conventions, The Baltic Centre, Great West Road, Brentford, TW8 9BU. Tel: (081) 847 2446. Fax: (081) 569 8688.

21st-23rd
Lisbon: 'Offshore Iberica'. Details: Conference Officer, OCS, 34-36 Apsley End Road, Shillington, Hitchin, Herts. SG5 3LX. Tel: (0462) 712049. Fax: (0462) 711889.

22nd
London: Course on 'Drilling for Engineers'. Details: SUT, PSTI House, Exploration Drive, Offshore Technology Park, Bridge of Don, Aberdeen AB23 8GX. Tel: (0224) 823637. Fax: (0224) 820236.

22nd–23rd
Prague: Conference on 'Oil and Gas in Czechoslovakia'. Details: Enerfinance Consulting Services, 69 Rue d'Hauteville, 75010 Paris, France. Tel: (1) 47 70 29 00. Fax: (1) 47 70 27 37/47.

26th–28th
Quebec, Canada: '9th International Symposium on Petroleum Economics'. Details: Marie-Claude

FORTHCOMING EVENTS

Jouvet, GREEN, Universite Laval, Pavillon JA DeSeve, Room 2245, Ste-Foy, Quebec, Canada G1K 7P4. Tel: (418) 656 2096. Fax: (418) 656 7412.

27th–29th
Madrid, Spain: 'CADMO 92 — Computer aided design, manufacture and operation in the marine and offshore industries'. Details: Pamela Spalding, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO4 2AA. Tel: (0703) 293223. Fax: (0703) 292853.

28th
Hemel Hempstead: Lecture on 'Pipeline isolation using remote controlled spheres'. Details: The Pipeline Industries Guild, 14/15 Belgrave Square, London SW1X 8PS. Tel: (071) 235 7938. Fax: (071) 235 0074.

28th–29th
Manchester: Conference on 'Profitable Waste Management'. Details: IBC Technical Services, Gilmoora House, 57–61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383.

29th–30th
Edinburgh: 'Oil Industry Nurses Symposium'. Details: Miss C Little, The Institute of Petroleum.

29th
London: 'Fourth North Sea Safety Conference'. Details: Technology Forum, Stanley House, Stanley Avenue, Wembley, Middlesex HA0 4JB. Tel: (081) 900 1555. Fax: (081) 900 1134.

29th
London: Conference on 'Oil and Gas Opportunities in the Former Soviet Union'. Details: Sarah Peace, IBC Technical Services Ltd, Gilmoora House, 57–61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

30th
Brussels: Symposium on 'Lubricants and Europe — The Challenges Facing the Community in 1993'. Details: Edward Hateley, Houghton Vaughan plc, Legge Street, Birmingham B4 7EU. Tel: (021) 359 6100. Fax: (021) 359 2458.

November

2nd–3rd
London : 'Fuel and Lubricants Retailing'. Details: WEFA Ltd, 60–62 Margaret Street, London W1N 7FJ. Tel: (071) 631 0757. Fax: (071) 631 0754.

2nd–6th
London: Two day course on 'North Sea Economics and Decision Analysis'. Details: DCA Consultants Ltd, Haughend Farm, Bridge of Earn Road, By Dunning, Perthshire PH2 9BX. Tel: (0764) 84664. Fax: (0764) 84665.

3rd
Aberdeen: Seminar on 'Advances in Pumping Technology for the Offshore Industry'. Details: Dr N Barnes, BHR Group, Cranfield, Bedford MK43 0AJ. Tel: (0234) 750422. Fax: (0234) 750074.

3rd–4th
London: Conference on 'Oil Pollution — Claims, Liability and Environmental Concerns'. Details: Susan Coulston, IBC Legal Studies and Services, 57–61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

3rd–4th
Berlin: Gas conference — 'Coping with transition'. Details: Overview Conferences, 82 Rivington Street, London EC2A 3AY. Tel: (071) 613 0087. Fax: (071) 613 0094.

3rd–4th
Oxford: Course on 'Aviation Jet Fuel — The significance of fuel quality in relation to properties, manufacture, testing and distribution'. Details: The Registrar, The College of Petroleum and Energy Studies, Sun Alliance House, New Inn Hall Street, Oxford OX1 2QD. Tel: (0865) 250521. Fax: (0865) 791474.

3rd–5th
Amsterdam: 'PetroTech 92'. Details: International Exhibition and Congress Centre Amsterdam, Europaplein, NL-1078 GZ Amsterdam, The Netherlands. Tel: 20 5491212. Fax: 20 6464469.

3rd–5th
Berlin: '4th EC Symposium — Oil and Gas Technology in a Wider Europe'. Details: Jane Kennedy, Petroleum Science and Technology Institute, Offshore Technology Park, Exploration Drive, Aberdeen AB23 8GX. Tel: (0224) 706600. Fax: (0224) 706601.

9th–13th
Singapore: Course on 'The Global LPG Business — Supply, Markets and International Trading'. Details: The College of Petroleum Studies, Sun Alliance House, New Inn Hall Street, Oxford OX1 2QD. Tel: (0865) 791474. Fax: (0865) 250521.

10th–11th
London: 'Marinflex 92 — flexible pipes, umbilicals and marine cabels conference'. Details: Mr Bob Gibbins, Marinflex 92 Conference Secretariat, 2 Tavistock Place, London WC1H 9RA. Tel: (071) 837 6362. Fax: (071) 837 0822.

12th
Sheffield: Course on 'Safe Storage of Hazardous Substances'. Details: Miss Maria Elliott, Division of Adult Continuing Education, The University of Sheffield, 65 Wilkinson Street, Sheffield S10 2GJ. Tel and Fax: (0742) 768653.

12th
London: Conference on 'Implications of Biocide Use within the Petroleum Industry'. Details: Miss C Little, The Institute of Petroleum.

12th
London: Conference on 'Resolving Problems in Seismic Data Management and Storage'. Details: Mr A McBarnet, Conference Director, Themedia Ltd, PO Box 2, Chipping Norton, Oxon 0X7 5QX. Tel: (060884) 700. Fax: (060884) 796.

14th–15th
London: Conference on 'Developments in the isolation of microbial products'. Details: Society of Chemical Industry, 14/15 Belgrave Square, London SW1X 8PS. Tel: (071) 235 3681. Fax: (071) 823 1698.

16th–17th
London: 'Oil and Money: Planning for Chaos'. Details: Brenda Hagerty, International Herald Tribune, 63 Long Acre, London WC2E 9JH. Tel: (071) 836 4802. Fax: (071) 836 0717.

18th
London: Conference on 'Oil Supply and Price'. Details: Miss C Little, The Institute of Petroleum.

19th
London: Conference on 'Developments in Aircraft Fuelling. Details: Miss C Little, The Institute of Petroleum.

Full automation on new generation drilling rigs

By Robert McLeod

The image of the roughneck on the drilling floor is probably one of the most enduring in the oil industry and the job is certainly one of the industry's most physically demanding. All that could be about to change as the next generation of drilling platforms become completely automated with consequences for work functions, manning levels and drilling costs.

The first of a new generation of drilling rigs has been delivered to the Norske Shell's Draugan platform in Stavanger. Impressed by the potential of the technology, the company has placed an order four times Draugan's size for the next set of rigs for the Troll development before a single offshore well has been spudded.

The unit being developed for the Troll platform will be the most automated drilling unit of its type anywhere in the world and will be capable of being operated by just a driller and an assistant. All aspects of the operations from pipe deck to pullout will be operated from inside a ergonomically designed control cabin offering a control system beyond anything currently in use.

The benefits of this approach will be reduced manning levels and associated costs but the drive behind its development lies in the quest for improved operational safety and — more directly — the Norwegian Petroleum Directorate (NPD).

In the preparation of detailed regulations concerning aspects of its Working Environment Act related to drilling operations, the NPD specifically wrote into the regulations requirements for companies to investigate ways to improve and extend automation on the drilling floor.

Mr Magne Ognedal, Director of Safety and Working Environment at NPD, maintains that there was considerable resistance in the industry to the development of automation on the drilling deck and saw the need to force the issue through regulation. Although considerable automation has taken place piecemeal, no overall design had been implemented and drilling floors remained relatively labour intensive and one of the most dangerous places to work. The overwhelming majority of accidents on rigs — some estimates put it as high as 70 percent — happen on drill floors.

'Removing the workers from the scene is one of the best ways of ensuring fewer injuries,' says Mr Ognedal 'and in the past we have seen far too many injuries and accidents in this area. Extensive automation is a necessary step.'

The extent of automation on the Troll rig will reduce the shift requirement by four and, assuming two shifts on two rotas, the total manning requirement by 16. There are also ramifications for reduced flights to and from installations which has been a contentious area of safety management for many years.

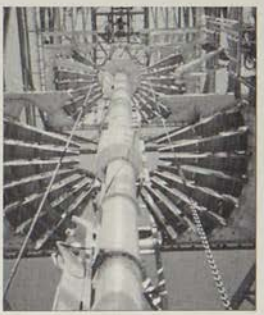
Capital expenditure

Whilst improved safety is a major benefit of full automation, operators are aware of the expenditure savings that can be made with reduced crews.

Capital expenditure for living quarters in the UK sector of the North Sea is estimated at £150,000 per man (£250,000 in the Norwegian sector). This means that total savings on a platform of eight berths would be £1.2 million (£2 million). Additional savings on wages, catering, flights, etc., for a drilling programme lasting three years would add up to an additional £12 million using the UK-sector estimate of £150,000 per man/per year.

Hitec-Dreco, an amalgam of the Norwegian company Hitec AS and Canada-based Dreco Energy Services, has won the Nkr600 million contract to engineer, procure and construct the Troll unit following the successful completion of the first contract for the Draugen rig. Although the Draugen rig has only just been delivered, the next unit will encompass several major modifications.

This new generation of drilling rigs has features which will seem revolutionary to most drillers but which are all based on proven technology. The console in the integrated cabin has been built using standard equipment operated from a specially constructed panel which means that restricted viewing of the drill floor, a feature of



Star racking system

many rigs, has been eliminated. All controls are within hand reach and direct line of sight and come with built-in back-up systems.

Pipe and casings on the deck are brought up automatically using a 'javelin' or articulated arm which lifts the pipe from the deck into position ready to be jointed in. An iron roughneck will make the connections after the thread has been automatically cleaned and doped. The mud and cement room will also be fully automated.

When pulling out, the tubulars will be lifted and stacked into a Star Racking system which consists of a radial fingerboard, again remotely controlled from the control room and removing the need for a derrickman.

Another major innovation is the use of an AC motor system to drive the drawworks, topdrive, mud pumps and pipe handling systems. Improvements in the design and size of AC motors means that better performance can be achieved over the normal DC motor drives.

The system also has a completely manual back-up. Should any of the automated operations fail, traditional manual methods can be employed to carry on drilling. This will require a multi-skilled workforce — which could meet resistance.

Hitec-Dreco general manager, Mr Norman Beeching, readily admits that Shell 'took a risk' when it contracted for the Draugen rig. 'A fully automated rig of this size and complexity had never been assembled before. When the order was placed the Star Racker hadn't even been built and much of the equipment was entirely new even if the technology was proven.'

Much of the technology has been in place to some degree in the Alaskan North Slope for 12–15 years but this is the first project to bring all the advances together.

'The drive for this technology has been supplied by the legislation passed in Norway,' added Mr Beeching. 'However, we now feel that, with the new contract for Troll and interest in Brent, the system is now the benchmark for future drilling rigs, particularly those with long-term drilling programmes.'

Unfortunately for the company, there will be few new buildings or refits in the drilling rig market for some years as low day rates and stacked rigs testify to a depressed market. But with their 'Phase II' development in Troll underway, the company is seeking to make the technology more competitive in purely financial terms in order to win new markets.

Integrated drillers cabin

New generation deep-water jackup rigs hold a key to future development, believes Mr Beeching, as tight margins for shallow water work mean that companies will go for 'automation by degrees'.

Much of the engineering for the current projects is undertaken in Canada where Hitec-Dreco have an established plant. Heavier and bulkier items such as mud tanks and electronic work is carried out in Norway. 'The particular circumstances in the region provide us with a good developing ground.'

The company believes, however, that there remains much to be done in the United Kingdom before this technology is implemented. 'The situation in Norway with the requirements made by the NPD is very different to that in the United Kingdom with the Health and Safety Executive,' maintains Mr Beeching. ■

Tough controls on oily water

A new generation of hydrocyclone liquid separators is being developed for use offshore for the treatment of produced water. With increasingly stringent environmental controls and the requirement by platform operators for smaller and lighter topsides, the manufacturers believe they have a ready and willing market.

Hydrocyclones were first used for solid/liquid separation in the mining industry more than 25 years ago and it was only following the Torrey Canyon disaster in 1967 that researchers from the University of Southampton, with input from BP and Serck Baker, investigated the possibility of using the technology in the oil industry.

At present there are two systems being marketed worldwide, although a number of companies in the United States are believed to be working on new prototypes. Vortoil Separation Systems, a subsidiary of Conoco, was itself the result of a merger between Conoco Speciality Products and Merpro Montassa Limited following a protracted and expensive patents dispute. The merger concentrated the supply of the units.

The origin of both these companies is understood to be another main supplier of separation systems, Serck Baker, which has recently launched its own range of non-rotating hydrocyclone units. The main difference between the units is the stacking arrangements. Vortoil's hydrocyclones are built into pressure vessels, while Serck Baker units can either be supplied in vessels or built in open racks.

The system itself is surprisingly simple. Oily water under pressure enters a two-metre long metal tube via a curved inlet which forces the liquid to spin. The tube, which narrows along its length, speeds up this spinning motion creating a centrifugal force which drives the heavier liquid, such as water, to the outside of the chamber, while the lighter fluids (such as crude) remains in the centre.

Complex pressure differences in the tube cause the oil to flow back in the opposite direction to the water and into the outlet.

Residence time in the tube is around 1.5 seconds and each tube has an operating capacity of five gallons a minute. To speed up the process, tubes are arranged in batches and depending on the design of the units and the number of batches, virtually any capacity can be achieved. A typical package — such as that installed on the Saltire platform — can handle up to 46,000 barrels of water a day.

Separation is easier for larger oil droplets, though the units can handle droplets as small as 10 microns. Manufacturers guarantee that residual oil content in treated water reaches 30 parts per million (ppm) which is well below the current legal discharge level of 40 ppm. In operation, however, levels as low as 10 ppm are claimed.

This could prove vital if proposed regulations specifying 25 ppm are implemented in the Norwegian and UK sectors of the North Sea. Such levels already exist in some offshore waters. These results were achieved without the addition of chemical oil-removal enhancers which could boost the systems effectiveness.

There are a number of benefits of the technology over traditional oil/water separation tank methods.

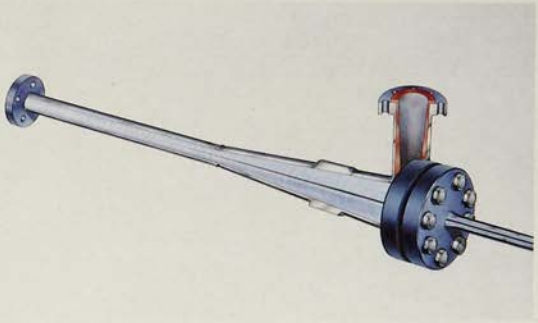
The system can function on operating pressures and removes the need for storage tanks and pumps providing a critical weight and space saving of up to 90 percent on traditional systems in the fabrication of topsides. In the bigger systems up to 50 tubes are housed either in racks or pressure vessels measuring 2·5 metres long and 900 millimetres in diameter. Because of the nature of the units they can be fitted retrospectively on existing installations.

Additionally, the systems require no moving parts, a factor which has ramifications for maintenance and service costs and contributes to the design life of 20 years. Whether this life can be met — and manufacturers believe it can be exceeded — will only be established with more experience. At present the oldest systems in place have only been in operation since 1985 — on Esso's West Kingfisher platform in Australia, where the first systems were commercially developed and installed.

Total capacity installed or under construction worldwide currently exceeds eight million barrels per day (b/d), with the biggest system being the 395,000 b/d unit operating on Arco's Prudhoe Bay field in Alaska. Total capacity in the North Sea (including the UK, Norwegian, Dutch and Danish sectors) exceeds five million b/d. Half of the worldwide capacity has been installed in the last 18 months.

Despite the savings in weight, space and material and the absence of moving parts, the capital cost of this latest technology is roughly the same as for earlier water separation techniques.

Robert McLeod



Serck Baker's Oilspin II.

The Institute of Petroleum

OIL SUPPLY AND PRICE SCENARIOS FOR 1993

Wednesday 18 November 1992

To be held at
The Cavendish Conference Centre, London

The oil industry faces a further period of considerable economic and political uncertainty in 1993. Economic recovery is likely to be weak and may be jeopardised by problems in the structure of the international banking and economic system. Political events worldwide will add to the uncertainty.

The Institute of Petroleum has organised this Conference to provide management and their planning advisers with an opportunity to hear a range of informed views on some of the economic and political factors which will influence the oil market and oil prices in 1993.

The keynote address will be given by **Mr David Simon,** CBE, Chief Executive, The British Petroleum Co plc

Speakers at the conference will include:

Mrs Helga Steeg, International Energy Agency

Mr Alhaji Abubakar Alhaji, His Excellency the High Commissioner for Nigeria

Dr Paul McDonald, Pearl Oil Ltd

Mr Peter Oppenheimer, Christchurch College, Oxford and Caminus Energy

Dr Irene Himona, Société Générale Strauss Turnbull Ltd

Dr Brian Sweeney, Arthur D Little Ltd

For a copy of the registration form, please contact **Caroline Little,** The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK. Telephone: 071 636 1004. Fax: 071 255 1472.

Woodside long-reach gas well breaks record

By William Scholes

Drilling engineers at Woodside Offshore Petroleum on behalf of the joint venture participants in the North West Shelf Gas Project, created a world record recently on the North Rankin A production platform by drilling a well which reaches out over five kilometres from the rig.

Although the well started off vertically to a depth of 300 metres, it was steered on a northeasterly direction and for most of the length is like a shallow inclined tunnel.

The total length of the well was 6,180 metres and reached down to a gas-filled sandstone 3,000 metres below the seabed and 5,009 metres to the northeast of the platform.

The previous record set in Norway last year reached 5,002 metres. Long-reach wells now make it viable for drillers to access distant hydrocarbon accumulations from an existing platform, previously not technically possible.

More than 200 people comprising drilling crews, engineers, marine crews, platform operators, managers, supervisors and onshore support staff contributed to the achievement at North Rankin. Attention to safety was the highest priority and no lost-time injuries were recorded during the project.

Woodside Offshore Petroleum's Executive General Manager, Peter Brown, said the achievement was significant to the drilling industry as it demonstrated Australia's 'home grown' capability and placed more oil and gas reserves within the reach of existing platforms.

Longest well

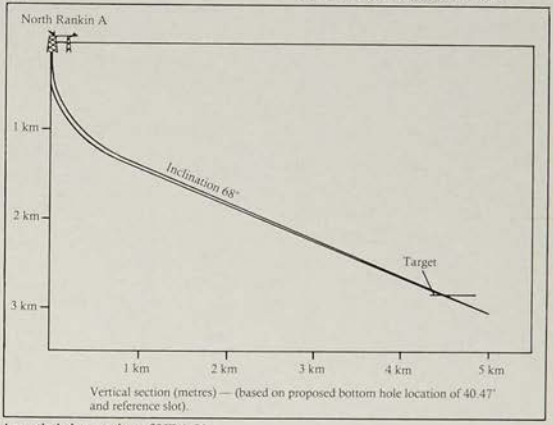
North Rankin A Number 21 is now officially the longest well ever drilled from an offshore gas/oil production platform.

The NRA 21 Project required 18 months of planning, engineering and equipment upgrade together with the latest drilling techniques and tool technology to complete the job.

Until recently the maximum reach of a production well was limited to 3,000 metres. In order to increase the drilling length, three areas were addressed — the North Rankin A drilling rig was substantially upgraded; latest drilling techniques were studied and personnel underwent extensive training.

In the process of drilling a well over such a long distance, several problems usually confront the drilling team. These include instability of holes through claystones and shales which are notoriously difficult to drill as they tend to swell and slough into the hole when stress is relieved as the hole is drilled. Hole cleaning also presents another obstacle. Getting the cuttings out of a hole is extremely difficult. Drilling mud circulation and thickness has to be absolutely perfect to successfully complete removal of cuttings and rock bits, Woodside officials explained.

Thirdly, drag and torque plays a vital role in long-reach well drilling. The drillstring is subject to frictional forces in the hole. The longer the hole, the more cuttings and cavings, the higher the friction. These forces can easily become excessive and stick the drillstring or fail it. Recovery from such a situation involves either 'fishing' or re-starting the hole from higher up in order to drill around the obstruction. This in turn can cause higher friction and so the situation gets worse.



An artist's impression of NRA 21

Long-reach drilling is an art form for drilling teams despite the application of the best technical ability. When engaging the forces of nature, luck also plays a part in the success of completing a well over very long distances.

However, the Woodside team was able to overcome all those obstacles by applying the best of new drilling technology and application of preventative measures. This included the use of heavier drilling muds, more gentle drilling and reaming techniques, an increase in drillpipe diameter and strength of the drillstring using a higher grade steel. Finally, downhole mud motors were used to get more drilling power to the drillbit without increasing drillstring loads.

The North Rankin A offshore platform can now draw natural gas from a total of 23 production wells, following the recent successful completion of a three-year drilling programme.

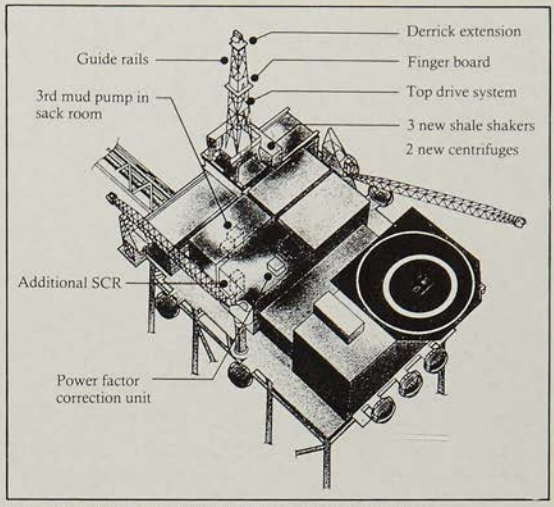
The programme, designed to boost the production capacity of the platform to meet liquified natural gas (LNG) export requirements, added 10 new wells to the platform at a total cost of $A150 million. It was a highly successful programme, which has given the platform direct access to gas reserves in the North Rankin field expected to total approximately 8.1 trillion cubic feet.

Apart from giving a major boost to the productive capacity of the platform, the drilling programme was also noted for technical achievements which have kept the North West Shelf Project at the very forefront of offshore drilling technology.

The third well in the programme (NRA 16) was a significant milestone, in that it represented the first attempt at a well that went beyond the design capacity of the platform's existing drilling facilities. The well was drilled to a total length of 5,330 metres, reaching out 3,775 metres from the platform at a depth of 3,259 metres beneath the seabed, enabling the platform to tap into a gas reservoir in the northeastern end of the North Rankin field.

Another major success came with the next well, NRA 22, which was not drilled on the main North Rankin field but into the sediments of the adjacent North Rankin West field. Although gas was found in the North Rankin West area some years ago, only 23 metres of poorly-developed gas sands were discovered, so interest in the area was low.

But the upsurge in development of 3D seismic interpretation techniques and new ideas related to the geological model for the area have had a significant impact on the understanding of the North Rankin West field. An upgrading of the potential of the area, coupled with the possibility of additional reserves nearby, prompted the drilling of NRA 22 in that direction.



Technical changes implemented on NRA drill rig and drilling facilities

The well was a great success for a number of reasons. Technically, it confirmed the presence of excellent quality gas-bearing sands and gave great confidence in the use of innovative mapping techniques based on new technology and ideas. The potential barrels-of-oil equivalent of North Rankin West makes it similar to the Cossack oilfield, also on the North West Shelf, and it has the additional benefit of being capable of being produced through the existing North Rankin A facility.

The last well in the programme, NRA 23, was another long-reach well which, although not quite as long as NRA 21, was at least as challenging and technically difficult.

New gas reserves

The new-found gas reserves from the North Rankin A platform will be needed to supply the expected leap in the demand for LNG in the Asia Pacific region at the end of the decade.

The 10 millionth tonne of liquefied natural gas from the North West Shelf project recently sailed. The Northwest Shearwater left the Withnell Bay terminal in Western Australia's Pilbara, bound for the Tokyo Bay LNG receiving terminal at Sodegaura.

Australia's biggest natural resources project, with a capital cost of $A12 billion, has generated LNG export revenues of $A1.8 billion since shipments began to Japan nearly three years ago.

Up to seven cargoes a month are now sailing to Japan, aiming at a forecast total of 4.54 million tonnes for 1992. Woodside Petroleum expects deliveries to rise to 5.14 million tonnes next year, 5.92 million tonnes in 1994, 6.73 million tonnes in 1995 and 6.9 million tonnes in 1996.

The commissioning of the third LNG production train in October and the arrival of the sixth LNG ship, Northwest Seaeagle, in November, and the seventh ship, Northwest Sandpiper, in February 1993, signals the completion of the initial phase of the project.

The sales of additional tonnage are made possible by the excellent performance of the first two LNG production trains at the process plant on the Burrup Peninsula. The trains are already producing above-nameplate capacity and the partners are considering a $A50 million programme, to enhance the plant's capacity. The study is examining modifications to the sulfinol absorber, more capacity in the dehydration unit, better performance from the plant's gas turbines and a reduction in air compressor fouling. ■

Subsea developments — the way to the future

By JQ Rahtz and NC Chambers, Rockwater Limited

Production from offshore oil and gas reservoirs using subsea wells has been in existence for 30 years. During this time, the philosophy has developed from single, experimental, satellite wells tied back to a conventional platform, to major fields developed entirely with subsea production.

The selection of subsea production in a development scenario can be driven by technological necessity in very deep water, by favourable economics compared with a fixed platform in medium water depths, to the only economic possibility for very small fields.

Large new fields in reasonable water depths in politically and commercially favourable areas are becoming increasingly rare. So attention is being paid to fields in deep water, to those in remoter regions and to smaller, more marginal fields. The development economic models for such fields will have a higher factor for risk and a greater sensitivity to variations in productivity, oil price and to forecasts of capital and operations expenditure. Subsea developments are therefore becoming increasingly appropriate.

However it will require the commercial development of innovative technology, a closer relationship between operator and contractor, a new field development role for contractors and the consequent reductions in capital and operations expenditure to provide the operators with an acceptable rate of return on the investment in these higher risk fields. For the industry to be sustainable, an acceptable return on investment will also be required for the suppliers and the contractors.

Subsea production

Subsea production has been used to recover oil to a surface-based process facility for over 30 years. In the UK Continental Shelf, it was first employed by Hamilton Brothers on Argyll in 1975 and, in the Norwegian sector, by Elf on Frigg in 1983.

The choice of subsea rather than surface wells is driven by a number of factors:

- Accessing remote parts of a field beyond the reach of wells drilled from the main fixed platform or platforms. The three subsea completions on Hewett Unit Area are a good early example.
- Developing a smaller field using subsea production tied back to processing facilities on a 'host' fixed or floating platform where the smaller or satellite field would not justify its own platform. The Texaco Highlander field in the Central North Sea is a typical example, being tied back to Tartan A platform eight miles away.
- Developing a field using a dedicated, field specific floater. Such fields can range from Argyll, with 70 million barrels recoverable reserves, to large fields such as Saga's Snorre field with 750 million barrels.
- Development of a number of small fields using a reusable floating production facility. Two current examples are BP's Seillean, used for the Cyrus and Donan fields, and the Petrojarl 1, being used on Amerada Hess's Angus field.

It can be seen, therefore, that subsea production has been utilised on projects with a wide range of parameters.

Subsea fields can thus range from: 20 to 2,000 metres water depths; 1 to 40 wells; 8 million to 800 million barrel recoverable reserves; and capital budgets from £20 million to £2 billion.

This wide range of existing producing fields accounts for some 140 live subsea wells in the UKCS and around 650 worldwide. There is a significant divergence in forecasts for future activities. Industry sources indicate a growth in UKCS of 240 subsea completions by 1995.

Forecasting future probable and possible subsea developments is an inaccurate science, due to the wide range of influences. A single change in one key factor such as oil price or developments in drilling technology, would have a significant change on the forecast. However, it is clear there is a dramatic growth in the numbers of subsea wells.

Subsea processing

Many of the smaller, potential fields in the North Sea and the smaller, deep water fields in the Gulf of Mexico

would not justify development on a stand alone basis. Where possible, the likely development scenario will be subsea wells tied back to an existing facility.

Two main areas of technology are addressing developments in fields beyond the 10 to 15 kilometre range, namely, separation of the phases and boosting of the pressure for multiphase flow. For step-outs of less than 10 to 15 km, two further areas are developing which will have a significant impact on the economics of small field and satellites within larger fields. These are Towed Production Systems and directional horizontal drilling. These four areas of technology are the major technological advances which will impact subsea field development planning over the next five years.

Separation

Subsea separation involves separation of the solid, liquid and gas phases on the seabed near the wellheads.

The solids would be captured and stored for periodic removal. The liquids phase, including produced water, would be pumped down one flowline, while the gas phase would flow under its wellhead pressure unaided in a separate flowline. Separating the liquids and gas removes the slugging problems encountered in multiphase flow, and the separation of the gas from the bulk water reduces the hydrate formation problem to manageable proportions (**Figure 1**).

A number of prototypes are in various stages of development and funding. one prototype, developed by BOET, was tested on a single well in the Argyll field and is now being developed for commercial use.

Another programme, under the name PRIME, is seeking funding to develop a totally packaged subsea separation scheme, in which great attention has been paid to lower operating costs by use of retrievable modules with multibore connectors (see page 500).

Another interesting project is VASP's, under development by Baker Jardine and Mentor, with significant oil company funding, particularly BP. This compact vertical separator can be installed in a dummy 30" conductor and thus can be deployed by a drill rig. The system incorporates an integral liquids pump to boost the pressure of the oil and water phase. It is possible to vary the configurations to suit a variety of applications.

Other current projects include Goodfellow Associate's GASP, Kvaerner Engineering's vertically arrayed separation and boosting station KSB, and Aker Engineering's TSSTS concept.

Multiphase pumping

The main alternative to separation is to boost the pressure of the wellstream to avoid slugging in the pipeline. Multiphase pumping has been developed under a number of programmes. Some pumps have been run on surface facilities both onshore and offshore (**figure 2**).

The closest to a live subsea application is the Shell Multiphase Underwater Booster Station (SMUBs) developed with Framo Engineering. SMUBs will be installed shortly in Shell's Norwegian Draugen Field on a well approximately 9 km from the platform.

Weir Pumps Ltd have been engaged in an active three-phase programme. The staged screw pump has undergone extended trials on an oil/gas multiphase test loop with support from BP. With further industry support, the project is now finalising the handling of the solid phase. The pump is essentially available for surface use. The engineering for subsea use will be the final phase.

Weir have just commenced a separate programme utilising downhole pumps to boost the pressure prior to the wellstream reaching its bubble point. This reduces the pump development problems, considerably due to constant gas oil ratio at this point.

The third advanced programme, Poseidon is sponsored by the Institut Français du Petrole, Statoil and Total. Poseidon encompasses a complete system, involving a modular subsea station, a multiphase export line to shore with remote control, and a subsea power line from onshore. This ambitious programme envisages multiphase flow for a distance of over 200 km, and would allow subsea fields to be brought onstream with no offshore surface facilities. Other programmes are ongoing with Bornemann, ASEA and Sultzer.

The key area for further subsea multiphase pump development is the drive unit for the pump. The power requirement in the order of 500 kw, combined with the need for a variable speed motor working in a subsea environment, has posed some interesting engineering problems. Hydraulic turbines as an alternative to electric motors, possibly using water pumped from the processing facility or the shore for water injection.

Both subsea separation and multiphase pumping are serious contenders for subsea developments greater than 10 km from a host platform. The economics for subsea separation become less favourable over very long step out distances, say over 50 km, due to the requirement for separate pipelines for the gas and liquid phases. Offsetting this is the greater complexity of rotating equipment required for multiphase pumping and the high

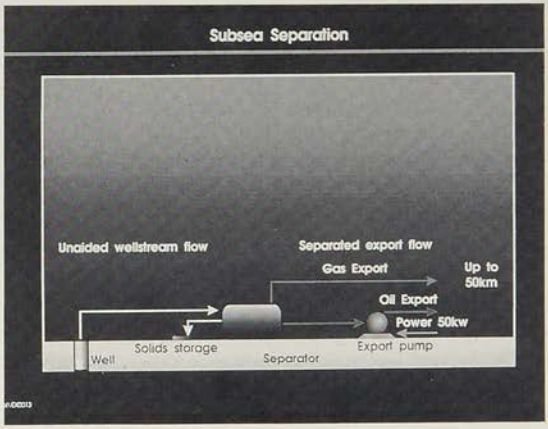


Figure 1: The main components of a subsea separation scheme.

power requirements, typically 500 kw, compared with the liquids export pump used for an equivalent separation scheme, typically 50 kw.

Towed production systems

For shorter step-out distances of up to 20km, capital and operating costs can be reduced by towing a prefabricated bundle, containing flowlines and a control umbilical, in a carrier pipe. By installing the bundle using the Controlled Depth Tow Method costs are substantially reduced. This technology has a good proven track record since the innovative first application by Conoco in 1980 on Murchison. A total of 21 bundles has been installed and a further four are under construction.

The structures on the end of the bundle have increased in size from a simple towhead to 130 tonne structures incorporating extensive equipment. The development of this technology to produce Towed Production Systems (TPS) is being undertaken in a major development programme by Rockwater.

TPS technology is an innovative development to integrate in one system, flowline and subsea facilities for installation in a single operation. Facilities such as valves, manifolds, controls, data acquisition and other production systems for field development, are housed within compact towhead structures attached to either end or within the length of a flowline bundle containing all the flowlines and control umbilicals. Various riser, well slot configurations and production options can also be incorporated into the system.

Manifolds, valves, controls and other production systems are fabricated with the flowlines onshore. Construction of the TPS onshore allows time and access not normally available using other techniques. Rigorous material and fabrication inspection allows the use of all grades of pipe materials from plastics to duplex stainless steels. The entire flowline and integrated systems are fully tested and proven prior to launching.

Towed installations can be transported by Controlled Depth Tow Method or bottom towing, to water depths ranging up to 2,000m. Launch and tow of the TPS to the offshore location is by established techniques, saving separate fabrication, transport, installation and hookup of the various integrated elements.

Existing pre-drilled wells may be tied back into the manifold on an individual basis, or from a pre-installed drilling template configured to suit the towhead. Future wells may be drilled, remotely hooked up, and brought onstream as desired.

TPS is compatible with the previous two technologies in that the towheads can incorporate separation systems or multiphase pumps.

Horizontal drilling

Horizontal drilling has now become a realistic option when either planning new, or adding value to old, field developments. As the operation becomes increasingly routine, the practice will become more important during the next decade.

The major advantage of a horizontal well is that the horizontal section within the reservoirs covers the pay zone for the entire length of that section. This is particularly important where the reservoir is thin. In these circumstances, a horizontal well may be a viable option where a vertical or inclined well would not. From a reservoir management point of view, a horizontal well, being parallel to the oil/water contact, is less likely to 'cone' water rapidly after coming onto production.

As well as drilling a well to 90 degrees, similar technologies have been used to drill extended reach wells. This has allowed small hydrocarbon accumulations to be exploited from existing installations. Recent horizontal drilling experiences in Norway have indicated horizontal distances of up to 7 km being feasible.

Horizontal drilling is also used in subsea wells. The technique will significantly decrease the number of wells required. With drilling and well completions typically accounting for 60 percent of the capital expenditure of a subsea field, the impact is dramatic. The main strength of horizontal and extended reach technology is that it will allow development of reserves not previously considered a sound economic prospect.

Fifteen service and equipment companies commissioned a worldwide study on the horizontal well market in order to obtain information for future trends.

'Horizontal Well Market Study 1990–95' published in 1991, said 'The long-term trend in the North Sea is definitely up, operators spent a longer time than expected evaluating these early wells. Best opportunities in the mid 90s include small field developments using subsea completions with horizontal wells...'

Standardization

The increased cost and manufacturing time for customised hardware, such as Christmas trees, has created market pressure for a degree of standardization.

The drive to standardization is a healthy sign in a well-developed industry and is perhaps a lesson that continuous innovative engineering does not necessarily produce cost effective results.

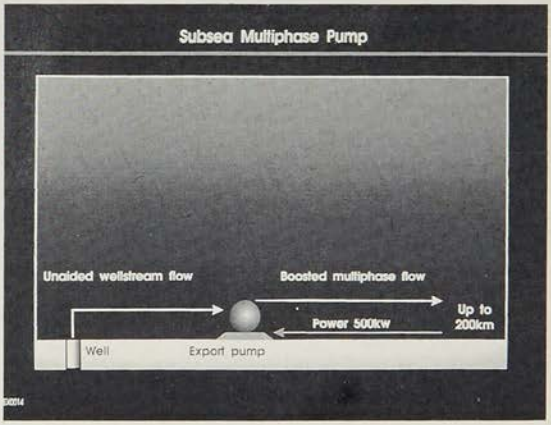


Figure 2: The main components of a seabed multiphase pumping scheme.

Intervention

The application of such technologies is appropriate for a wide range of water depths. The significance of increasing water depth is the intervention requirements for installation and operation.

Diving intervention

The trend is for a reduction in use of divers from fixed platforms and drill rigs, in favour of ROVs. This follows the general economic desire to reduce manning of platforms, and also the safety considerations of evacuation of divers in compression during an emergency.

Most North Sea diving is from purpose built diving and construction support vessels with integral dive systems. The sophisticated controls and equipment onboard, combined with robust safety management practises, has minimised diving related accidents. Close co-operation between the diving industry, the Department of Energy and now the Health and Safety Executive, has resulted in a safer industry.

The major improvements over the last decade have been in the support vessels.

The losses sustained by the subsea construction contractors and their equipment suppliers over the last four years will lead to further consolidation and a lack of funds to invest in new equipment and technology. Furthermore, the increase in returns on investment required to provide a sustainable industry will put great pressure on contractors and operators alike to explore new ways of reducing field development costs.

Diverless intervention

There is a huge variety of ROVs in the market with capabilities ranging from observation only to one-off specialised vehicles built for complex field construction and maintenance tasks.

The basic vehicle part of the ROVs involved in work activities have undergone little change over recent years.

Most development is in the area of tooling packages for specific tasks, either as part of a development project, such as, Esso's DMac programme or for live work programmes.

One atmosphere diving suits (ADS)

ADS, particularly the recent Newt Suit, will provide intervention capability for subsea human intervention for platform and drilling support where topside safety considerations will inhibit diving.

Current diving practice is limited to depths of around 300 metres. This is not an absolute maximum, indeed Norwegian diving regulations require a dispensation to exceed 180 metres. Thus, in the range from, say, 150 metres to 600 metres, consideration will be given to diverless intervention.

The need for human intervention either as a prime means or as a back up will provide opportunities for ADS.

Market pressures will always result in improvements to current intervention systems. However, in broad terms, the current status of saturation and one atmosphere human intervention and of ROV robotic intervention, is adequate for subsea construction and maintenance and the limited degree of investment in related research and development is unlikely to inhibit future subsea field developments.

Total Quality Management

The overall picture painted above includes exciting developments in technology in an economic environment of high risk and inadequate returns on investment. This may sound like the death knell of the industry and clearly an avenue is required where the risks can be properly managed and the operators and their contractors and suppliers can achieve their financial goals.

Total Quality Management is providing this avenue. An unprecedented atmosphere of openness and trust is developing among the participants, and the resulting comprehension of needs is showing the clearest route forwards. Only those companies totally committed to TQM can expect to share in this future.

A study by a major service contractor in the Oilfield Service industry identified a global annual market of US$17 billion for its range of services. Research showed that the oil companies recognised a total spending of US$42 billion for these same services. Using analytical tools, such as, Linkage of Process, the processes leading to this gap in perception of the value of services can be narrowed. In Juran terms, this will involve the elimination of 'Chronic Waste'.

TQM programmes, such as Shell's WIN 90's and BP's broadranging quality initiative, are aimed at reducing the gap thus reducing the operators' overall expenditure whilst contracting out more services. This will lead to contractors managing a greater position of the subsea development, with guidance and direction provided by the operator, rather than direct and overlapping management.

The changing relationship will lead to the end of the adversarial aspects of contracting.

The new relationship provides a forum in which both parties to a contract can benefit. It will, however, require a great commitment to TQM and the accompanying cultural changes.

Conclusion

The economic realities of developing small and deep water hydrocarbon reserves are daunting. However, there is a dramatic growth in the number of subsea wells indicating that subsea production of oil and gas has a relatively healthy future even in an environment of fluctuations in oil price.

Technology will play a major part in advancing new fields developed with subsea production, as well as sustaining existing ones. For operators to benefit from a good return on investment in the higher risk fields, innovative technology, by way of subsea processing, separation, multiphase pumping, Towed Production Systems and horizontal drilling must continue to be commercially developed. The trend for a reduction in diver intervention and an increase in diverless technology is already being implemented on a broad scale, although human intervention is currently at its safest due to sophisticated equipment and stringent safety management.

Hand-in-hand with the cost-effectiveness of progressive technology is the philosophy of Total Quality Management. Whilst an even closer relationship between the operators and their contractors and suppliers is desirable, there are already examples of openness and trust. TQM will assist in the participants achieving their financial goals because it not only involves managing the risks, inherent to the industry, through greater communication over safety and quality but also by reducing the operators' overall expenditure. A new relationship between operators and contractors will evolve, based on a greater understanding of each other's business, existing knowledge and expertise, and such collaboration will lead to mutual gain.

A sustained commitment at all levels to developing technology and Total Quality Management will lead the industry into exciting new waters and stimulate its expectations of a long-term future. ■

This paper was presented to the IP Exploration and Production discussion group.

Purpose-built seabed processing systems and products for the recovery of subsea hydrocarbons

By David Appleford, Managing Director, Alpha Thames Engineering

Three years of engineering effort have yielded the design and detailed engineering for the development and demonstration of a seabed processing system aimed at subsea marginal oilfields. This effort has been supported, both technically and financially by several oil companies, some of whom have provided actual field data for analysis. The fields concerned are those with insufficient reserves to justify the capital cost of currently available conventional production systems but could be economically exploited by means of partial separation of liquid and gas products on the seabed.

In the North Sea in particular, the trend in recent years has been towards the development of smaller fields, often tied back to existing platforms. This trend is expected to continue, with seabed processing greatly increasing the viable step-out distances.

The PRIME seabed processing system developed by Alpha Thames Engineering, is aimed at this market and has been specifically designed to take surface type technology to the seabed in a novel, pre-packaged, modular form; thus facilitating pre-installation testing, installation offshore, diverless maintenance and subsequent recovery of equipment at the end of field life.

The problems

There are a significant number of discoveries, particularly in the North Sea, which are as yet undeveloped. Although these fields lie in moderate water depths (less than 180 metres) they are likely to remain unexploited because of a combination of factors — reserves, location and production characteristics.

In considering recoverable reserves, these are usually sufficient to be of significant economic value but not enough to justify the cost of a dedicated, on-site production system with full processing and export facilities.

The location of these fields is generally too far from existing production facilities for their infrastructure to be used, for example by directional drilling. Also a conventional subsea satellite system would be impractical because the pressure drive in the reservoir is insufficient to flow to the sea surface, let alone produce through long runs of pipeline in multi-phase flow. Alternatively, the field may be able to sustain remote flow initially when reservoir and wellhead flowline pressures are high but could not do so over the entire field life.

Reservoir producing characteristics may require the use of gas lift, or the produced fluid may be distinguished by high natural gas/oil ratios, both of which may contribute to adverse multi-phase flow regimes in the pipelines between field and host platform.

The technical solution

The objectives are to design, build and test an integrated seabed processing and pumping system for exploitation of marginal fields, particularly in the North Sea.

Oil companies were approached at the outset to supply representative field data and this formed the basis of the process and mechanical design. The principal features of the design basis are:

- Handling of up to 20,000 bl/day from two producing wells (with two water injection wells) through one train, with single stage separation;
  (Further trains may be added in parallel for larger reservoirs)
- Booster pumping of liquids, if necessary, back to an existing platform;
- System suitable for any water depths;
- All components which may require maintenance or repair retrievable to the surface without diver assistance;
- Non-fiscal quality oil and gas export to an existing platform up to 50 km distant.

Process considerations

The seabed processing system ensures continuing economic oil production through an extended field life by means of a separation and pumping system located close to subsea wells.

Separation of the liquid and gas phases close to the production source enables both gas and liquids to be delivered separately to a platform located a greater distance away than would be possible with a mixed phase product. The project uses a conventional single-phase constant speed pump to boost the liquid pressure sufficiently to overcome static head and frictional losses between seabed facility and platform, leaving the gas to flow under its own pressure. Any desired liquid flowrate may be easily

achieved by appropriately sizing the relatively low powered pump.

After separation, the gas leaves the separator substantially dry of condensate but as the pressure and temperature fall, most typical gases will drop out some condensate. This can build up into unwanted slugs in some instances and will also call for hydrate inhibition since the gas will inevitably be water wet. Glycol or methanol will be injected into the gas stream as it leaves the separator, as well as into the wellhead at shutdown and just before start-up.

The liquid pipeline will not be subject to the above problems provided that the pump is sized to ensure that pressure is maintained above the bubble point at all times.

If lift gas is required it would be the associated gas from the field itself, with water and the heavier hydrocarbons removed on the platform. The lift gas flow is circular so it would not reduce the gas product flowrate.

It is desirable to keep as much control equipment as possible on the platform, for obvious reasons. The three parameters that need to be controlled are separator pressure; separator level and product flowrate.

Gas pressure can be controlled by means of a back-pressure modulating valve, in association with a relief valve. The separation pressure subsea should lie between 30 to 40 bara. At this pressure the great majority of light ends will flash to the gas phase, where they can be easily inhibited. Should the gas pressure rise above the set maximum, the relief valve will open and relieve gas to the flare or vent. Because of the combined separator and pipeline volumes, the gas system has a huge capacity for damping out rapid changes in the gas flowrate, thereby making control of separator pressure relatively easy.

Several schemes have been examined for controlling separator level, which must be maintained within certain limits which prevent gas priming at high levels; give adequate time for gas disengagement at low levels and even out variations in flowrate.

The scheme selected depends on a fixed flowrate set by the wellhead chokes, which may or may not be remotely adjustable depending on the operator's requirements. An ESD valve, fitted immediately up stream of the separator inlet, protects vessel and down stream equipment from pressure surges. Down stream of the separator, the level is controlled by a modulating valve located on the platform. This valve is controlled by level monitoring instruments mounted on the separator, which is designed to operate with a liquid level close to its centreline where the surface area is greatest for gas evolution. The time for the gas to break out of solution determines separator size. In practice the system operates normally with the separator liquid level free to vary within set limits, giving the control system time to react.

The pump is designed to run continuously at constant speed. Closing the platform mounted liquid level control valve increases back pressure on the pump, causing it to work further back down its characteristic curve where the differential head is greater. The flow rate therefore decreases. To prevent possible pump damage due to very low flowrates, a small bore bypass line coupling pump outlet directly back to separator is provided. This bypass would run full at all times the pump was on, adding a small percentage to the pump power requirement.

One particular virtue of this scheme from the process point of view is the compatibility with gas lift, currently the only feasible, generally applicable technique for artificial lift of subsea wells.

In addition, separation of the light hydrocarbons in the gas phase from the bulk of any produced water in the liquid phase minimises the risk of hydrate formation in the gas line and allows economic continuous hydrate suppression by injection of methanol or glycol. If glycol is used it can be recovered at the platform because it is not associated with (saliferous) formation water, but with condensed, (salt free) water vapour; export line hydraulic performance exhibits lower pressure drops than full stream multiphase flow, is less subject to damaging transients and is more easily modelled and predicted; fluid streams received at

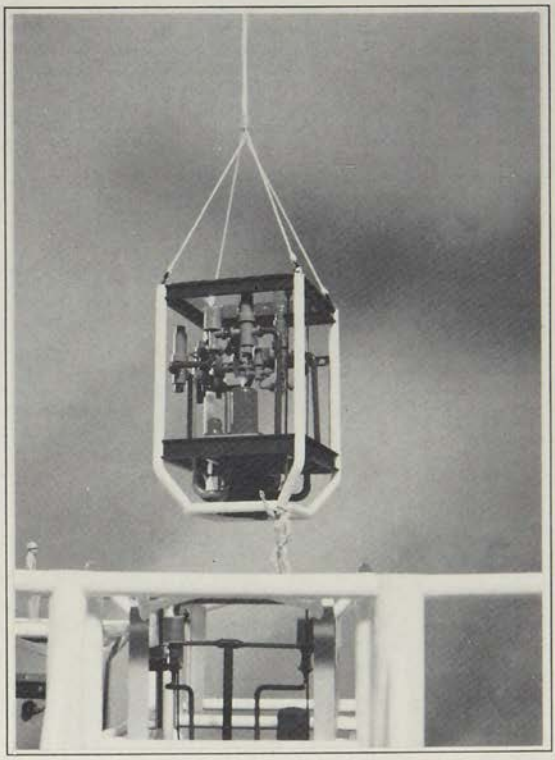


Figure 1: Typical primary module (production choke).

the platform are more readily accepted and commingled into existing production on a mature platform than a single stream of full well fluid. Platform support requirements including power, control and chemical injection should not need major topside modifications.

Mechanical design guidelines

The general basis for the mechanical and structural design of the seabed system has evolved over a period of time following an extensive analysis of existing systems and components and their advantages/drawbacks.

- All components likely to require maintenance or repair should be retrievable to the surface. These would include valves, chokes, instruments, pumps, separators, etc.
- A modular system would be adopted for IMR purposes rather than retrieval of individual components. Modules however, would be designed for ease of accessibility by ROV for certain operations, eg choke adjustment.
- Modules should be a uniform, standard size as far as possible.
- Module installation and retrieval should be diverless and ultimately, guidelineless.
- Inter-module connections should be made as simple as possible.

Module arrangements

In a multi-module system, the units can be arranged in three basic ways:

- Stack-up arrangement (vertical connection);
- Side-by-side (horizontal connection);
- A combination of the above.

For a subsea production system which is of a diverless concept, retrieval of the modules is readily achieved if required for maintenance or repair purposes. Also, each module forms part of an integrated system and requires connections between itself and other modules, resulting in many process and control connections at module interfaces. The application of multi-line connection is coupled with the need for high integrity. This demands selection of a system which enables connections to be achieved in the simplest and most effective manner.

The system adopted divides the modules into three types. These are:

- Primary modules
- Secondary distribution modules
- Main header modules

Primary modules contain items such as valves, chokes, control pods, separator vessel (and its instruments) pump, motor and transformer. Most of these items are likely to require maintenance at some time during field life.

A typical primary module is shown in **Figure 1.** All process flows are routed through a multi-bore isolated connector at the base of the module. This provides a single datum interface which has several advantages. For example, when lowering a module into position, the connector provides both final precision alignment and connection of several process lines in one operation. A suitable through-bore, piggable connector (MATE) which also has the unique facility of being internally valved is currently being developed which would eliminate the need for separate shut-off valves on each process line.

Secondary distribution modules have two functions namely to provide the interconnecting pipework between primary modules and to provide a guidance framework for primary module installation. **Figure 2** shows such a module containing two primary modules, in this case a separator module and a pump module. Normally a secondary distribution (SDM) would not need to be retrieved whilst in service, containing only passive items of equipment such as pipework. If however the connector seals need replacing the module can be pulled.

SDMs are linked via a main header module, again by means of vertical multi-bore connectors, providing the process piping connections between SDMs. There are no seals in the male halves of these connectors, thus there should be no need to retrieve the main header module during field's lifetime.

Primary module dimensions have been standardised at 4 metres × 4 metres × 6 metres high, except in the case of the separator module which needs to be 9·5 metres long to accommodate the horizontal separator vessel. Primary module weights have an upper limit of 50 tonnes again with the exception of the separatory module which is somewhat heavier.

SDMs weigh about 100 tonnes and their dimensions preclude handling through a DSV moonpool. A large DSV could handle both primary and secondary modules either through its moonpool or over the side. Special attention has been paid to module design to facilitate installation. The single datum connection philosophy greatly assists in this respect. Initially guidelines would be used (ROV attached). Ultimately these would be dispensed with as handling was gained.

Each module will be equipped with its own slave control pod routing control signals to a master control pod located in a dedicated controls and chemical injection module. Inter-module connections will be made by horizontally mounted electrical connectors and vertically mounted hydraulic and chemical injection

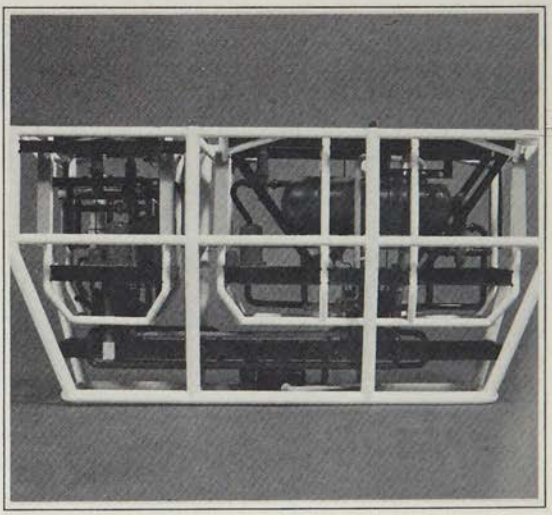


Figure 2: Secondary distribution module containing pump and separator modules.

connectors (located next to the main module connectors). All electrical connections will be made at primary module level, thus ensuring that both halves of the electrical connector can be easily retrieved if necessary. The master control pod will communicate with the platform via an umbilical containing a fibre optic cable.

High power will be sent from the platform directly to the pump module, where it will be transformed down to the voltage required by the electric motor. As previously mentioned the pump motor is of the simple, constant speed type. A new design of high voltage subsea-mateable connector for this application is presently being developed.

Throughout the field's life chemicals will need to be injected at various points in the system. Glycol or methanol for hydrate inhibition will be supplied via small-bore piping in the umbilical for continuous injection into the export flowline. Separator efficiency will be kept as high as possible to limit inhibitor quantities and hence umbilical size. Batch injection of other fluids will also be required at certain times, for example shut-in or start-up of production.

Pressurised storage reservoirs for this purpose are provided in the control and chemical injection module.

Benefits

With a completely integrated modular seabed processing system, the key benefits can be summarized as follows:

- The hydrate formation problem is minimised. The separation process separates the bulk of produced water from small molecule hydrocarbons. The liquid stream is then not susceptible to hydrate formation.
- The gas phase can be economically inhibited. Further, because water formed in the gas line is condensed water vapour, it is salt-free (unlike the formation water in the liquid line). Glycol (hydrate inhibitor) in the gas line can then be recovered by distillation.
- Carbon dioxide problems are minimised. The separation process separates most of the carbon dioxide with the gas where it can be inhibited with chemicals similarly to hydrates. This also avoids the extra cost incurred by having to use alloy steels for the pipelines.
- Single-phase flow through separate gas and liquid lines causes lower friction loss and higher flow rates than multi-phase flow. These benefits occur before liquid phase pumping is necessary.
- Location of the separator on the seabed reduces back pressure on the well, allowing improved productivity, possible fewer wells and greater reservoir draw down at EOF life. Back pressure reduction is approximately equal to the hydrostatic head of produced fluid from the wellhead to separator deck. Thus, the deeper the water, the better a subsea separator performs in enhancing well performance.
- Subsea separation is very compatible with gas lift. Gas lift is currently the most feasible option for artificial lift of subsea wells and is in use in many North Sea fields.
- Extra gas improves vertical flow in well bores but hinders horizontal flow in flowlines and pipelines. Removal of the gas in a subsea separator near the wellhead allows vertical and horizontal flow regimes to be optimised.
- Further, the seabed pumping duty does not increase with increasing gas lift rate, as the field declines, unlike the situation for multi-phase pumping in association with gas lift.
- At EOF the main field water cut is at its highest, as is also gas lift if used to overcome the increasing static back-pressure of the liquid column. The total liquid flowrate remains relatively constant if the reservoir pressure is maintained. EOF conditions thus often define the first stage separator design. Start of field (SOF) conditions usually define the second stage separator design because the oil and associated gas rates fall with time and water is already separated. Primary separation subsea avoids the potential first stage bottleneck, feeding separated liquid and gas direct to the second stage using some of its spare capacity. However, additional second stage water handling facilities may sometimes be needed.

The modular seabed processing system will allow the transportation of production from small oilfields, or large fields which are nearing the end of their life, where stepout distances are in the range of 10–50 kilometres from an existing offshore oil production facility or land base. The system could also be located beneath platforms or tension leg platforms in water depths greater than 300 metres.

As the essential components of the process system will be required in each and every system, the result will be to minimise capital expenditure and to reduce operating expenditure generally as detailed below:

- A reduction in design and manufacturing costs for items produced regularly over many years.
- Increase in quality of manufacture and therefore reliability as a result of regular production.
- Standardisation will lead to shorter and more accurate delivery and installation times, enabling fields to be developed more precisely within a specific time band to justify an economic return.
- By utilising a standard system incorporating tried and tested key components development risks are reduced.
- Once the system has been proven, project management time and cost would be substantially reduced.
- Inspection, maintenance and repair will be undertaken by remote means during the field life, thereby eliminating the need for expensive diver-support.
- As oil is processed subsea, safety for the topside personnel is increased. Further enhancement will occur should eventually topside and onshore systems also become unmanned.
- It will be possible to retrieve primary components on abandonment for reuse elsewhere as required.
- By using standard structures and components it may be possible to use submarines for handling installation and IMR work. The submarines would be able to work all year round thereby reducing high risk and cost to operators during adverse weather periods.
- As costs and development times are reduced, more fields will become viable for exploitation.

Project Status

The next stage of the project is to build and test the pump and power module, closely followed by the separator and secondary distribution modules. Submerged testing will take place in a dry dock equipped with a suitable plant to simulate the production of crude oil for separation purposes. Following completion of dry-dock testing the prototype will undergo offshore trials tapped into a convenient hydrocarbon production system. The complete programme has been scheduled to take two and a half years. ■

Acknowledgement

This paper was presented to a conference, 'Satellite and Marginal Oilfields' held in London in June.

Standardization News

An overview of the current work of the ISO Petroleum Products and Lubricants Committee TC28

The Advisory and Plenary meetings of ISO/TC 28 held during June in Philadelphia, combined with the opportunity for immediate follow-up, at the ASTM D.02 meeting in Kansas City, of many of the identified action items, probably ranks as the most successful periods in this committee's history. Of course, the success will only be able to be measured by the speed and volume of the output which follows but the identification of project leaders (or the commitment to supply draft text) together with the imposition of target dates on most of the current work items should provide a framework for focused and measurable progress. The new ISO Directives will also help, in particular the ability to 'edit' without ballot. This should enable the committee over the next five years to produce a coherent portfolio of Standards which conform to a relatively consistent format and style. It will also allow a much more rapid response to changes in requirements for safety caveats and to update references. This will be particularly crucial over the next two or three years when we can expect over 50 'new' Standards to be published, which could effectively outdate the references in a raft of others quoted in specifications. Already some of the references quoted in the new CEN automotive fuel specifications currently out for ballot are obsolete, e.g. ISO 8754, ISO 3015 and ISO 5165 (published May–July 1992 as new or revised versions). However in view of the need for petroleum standards for the various European and international specifications, ISO have agreed to give TC28 'enhanced status' and with this new status a further 6–10 Standards can be expected to be published this year.

Determination of MTBE in Light Distillate Feedstocks

A correlation exercise has been conducted on Proposed Method BG (Determination of MTBE in Light Distillate Feedstocks), which has indicated the need for some modifications to the method before re-correlating. The level of participation in the development of this method has fallen such that there now remain insufficient laboratories to establish a precision statement. The method underpins an open specification for feedstocks of 50 parts per million. However the current situation will result in the withdrawal of the method within four years. In order to protect and fully establish this method, additional potential participants are asked to contact the Chairman of ST-G-6 at the following address: Dr Peter Lyne, BP Research, Chertsey Road, Sunbury-on-Thames, Middlesex TE16 7LN.

Methods of Test involving Gas Chromatography

In line with current standardisation policy within the Institute of Petroleum, the Gas Chromatography panel (ST–G–6) is conducting a review of all methods within its responsibility. Prior to converting old methods into ISO format, the panel requires to determine the current usage and relevance of this methodology. In some cases it is likely that a requirement remains, but a different methodology should be applied. Comments would be welcome from anywhere in the industry regarding the following methods:

194 Butadiene purity and hydrocarbon impurities.
221 Analysis of heptenes.
282 Hydrocarbon impurities in commercial benzene and toluene.
296 Characterisation of pollutants of petroleum origin on seas and beaches.
318 Characterisation of pollutants of petroleum origin.
337 Analysis of non-associated natural gas.
372 Carbon number distribution of paraffin wax.

Comments should be addressed to the chairman of ST–G–6: Dr Peter Lyne, BP Research, Chertsey Road, Sunbury-on-Thames, Middlesex TE16 7LN.

New IP code of practice

The Institute of Petroleum has recently published Part 17 of its Model Code of Safe Practice — *'Well Control during the Drilling and Testing of High Pressure Offshore Wells'*.

The Aberdeen-based committee in charge of producing the code was chaired by Ted Williams with Alan Lodge as secretary. Consultancy work for the code was funded by the Health and Safety Executive.

The code is a guide to safe practice for those concerned with well control during the drilling and testing of high pressure offshore wells. It is intended to provide information and guidance on those well control activities associated with high pressure wells which have an impact on safety offshore, and therefore require detailed care and attention. The code has been produced in a United Kingdom Continental Shelf context, but the principles and recommendations have general relevance to similar operations elsewhere.

The Code of Practice should be considered as a starting point for the operator and drilling contractor in developing the drilling programme and associated operational plans and procedure for a high pressure well. While these guidelines offer definite recommendations, they are only a starting point. Each operator should review and apply the guidelines according to its own policies and experience for the particular area of operation.

Each chapter of the code covers an important aspect of well control and has an introduction which describes the part each activity plays in the drilling and testing of high pressure offshore wells.

In the national areas where high pressure offshore wells are being drilled and tested there will be statutory requirements, regulations and rules both local and national which apply to activities relating to such wells. This code should be regarded as complementary to these requirements but not in any way supplanting them.

The code is available from John Wiley & Sons Ltd, Baffins Lane, Chichester, West Sussex PO19 1UD. Tel: 0243 829121. Price £60.00.

On-line fiscal measurement of water content

A field-proven water cut monitor using microwave technology to accurately measure the water content in oil in the presence of free gas, variations in salinity, crude type and fluid temperature has been developed by Texaco Inc. The exclusive worldwide licence for the manufacturing, marketing and support of the StarCut monitor has been awarded to Jiskoot Autocontrol of Kent.

Texaco Inc has developed a range of proprietary water content measurement technologies suited to crude oil for which Jiskoot also has licence agreements. The most accurate of these technologies is the field-proven StarCut which provides fiscal accuracy (0.05%) water content measurement over a range of 0–100% water. This overcomes the traditional limitations of capacitance, density and low frequency based technologies.

The company maintains StarCut is the only technology currently available using frequencies in the accepted microwave range. Signals at 10 GHz are passed through both the flowing stream and a reference cell which are sampled at 300 Hz providing the StarCut the ability to measure the full phase range in a rapidly changing mixture, typified by slug flow conditions.

The unit measures temperature, microwave attenuation and phase shift to determine the water content and can also measure salinity and density.

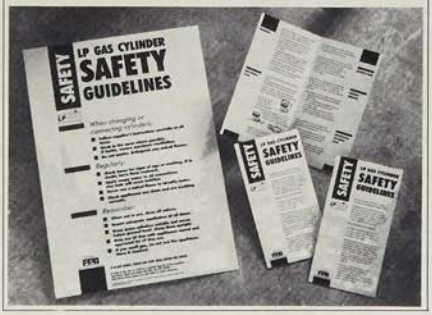
The StarCut comprises a cell through which the media flow and is directly attached to the system electronics which comprise the microwave elements, computer system and operator interface/display. The unit is available certified for Class 1, Division 1 hazardous areas and has been approved for subsea use. Outputs are both analogue and serial with the capability to provide remote maintenance via modem link. The StarCut also has the ability to provide nett oil totalised volumes when a flowmeter signal is input to the system.

The StarCut is designed for installation at wellheads or on production/test facilities.

New safety literature published

The LP Gas Association has published a leaflet and a series of posters outlining safety procedures for anyone using LP gas cylinders. Endorsed by the Fire Protection Association, this initiative marks an important step in the industry's efforts to increase safety awareness among its customers.

Copies of the leaflet and posters are available from the LP Gas Association, Alma House, Alma Road, Reigate, Surrey RH2 0AZ. Tel: 0737 224700.



Personnel lifting winch

Ingersoll-Rand has launched the new Manrider series of air-powered personnel lifting winches comprising two models offering 0.5 and 1.0 metric ton capacities, respectively. The winches are designed to meet all of the standards set by the world's classification societies for personnel lifting operations on offshore installations. The winches have been type approved and certified by Det Norske Veritas and other approvals are pending.

Other features designed specifically for the offshore environment include high efficiency planetary gearing inside the winding drum for minimum overall dimensions. They are delivered mounted on a skid for easy installation and have a durable paint finish to withstand the rigours of marine/offshore environments.

A feature of the winches is the gear type air motor that can operate even with poor compressed air quality or in difficult environments. The winches have dual automatic brakes acting independently, one a disc brake and the other a drum band brake, both capable of holding 180 percent of SWL.

Additional braking safety is provided by an internal non-return device preventing suspended loads from slipping before upwards motion is activated by the motor. Lowering speed is also controlled by an internal motor valve to prevent excessive speeds.

Control is provided by a lever on the winch motor with fine inching characteristics and automatic return to neutral with brakes applied (a deadman handle). The drum is dimensioned to allow use of various standard wire ropes with safety factors up to 10:1 and a drum guard is fitted as standard.

Gas analyser is computerised for speed and accuracy

Houston Atlas has extended its range of hydrogen sulphide gas analysers with the introduction of a new computer directed model, designed for oil and petrochemical, environmental, process, combustion and associated applications.

Designated Model H2S-VII, the analyser utilises integral computerised supervision to enhance accuracy, reliability, versatility and provide rapid response times. Calibration is simply achieved by inserting a standard sample and following the menu prompts on the computerised display. The analyser then performs the rest.

Analysis is by means of the lead acetate detection method, utilising push-in 'Detectassette' tape cartridges which are easy to replace after a life span of approximately thirty days in normal use. Key parameters are set with 'Magna Touch' controls without opening the explosion proof analyser enclosure, which is certified for use in hazardous environments.

Forward planning for contaminated land

ERL EnviroClean is pioneering a new risk assessment methodology for the investigation and treatment of contaminated land in the United Kingdom. The process matches human health risks with possible future uses for a site and is of interest to companies whose sites are likely to be included in contaminated land registers when a potential problem has been identified but risks need to be quantified prior to remediation (under Section 143 of the Environmental Protection Act 1990).

Texaco recently commissioned ERL EnviroClean to assess potential future risks at a former oil storage terminal at Carrickfergus in Northern Ireland. 'When Texaco has finished using a site, we want to be sure there is no environmental risk left behind,' explained Richard Head, the company's coordinator for environmental affairs. The land at Carrickfergus, which has been leased from the local council, is scheduled for commercial development and is set to form part of a proposed marina development in the area.

In the first phase of its work for Texaco, ERL EnviroClean, part of the ERL group of companies, was asked to carry out a baseline environmental study taking account of factors such as geology, hydrogeology and potential soil and groundwater contamination.

'We carried out a sampling and analytical programme to characterise the nature and extent of contamination present,' explained ERL EnviroClean senior consultant, Caroline Cook. Stage two involved further investigations to determine the extent of contamination and included a risk assessment focusing on the future use of the site. The approach is a departure from traditional risk assessment methods which have tended to follow set guidelines for contamination levels regardless of how land is to be used in the future.

'The way in which a site is to be used governs the degree of risk. Soil contamination, for example, becomes more important if a site is to be used for agricultural land than if it is to be turned into a car park,' explained ERL consultant, Andrew Jackson.

The ERL EnviroClean system can be used to assess human health risks for any proposed land use from light industrial and commercial to public amenity and housing. Where appropriate, suitable clean-up remedies are produced by using computer analysis to measure toxicological data against that arising from a particular change of use.

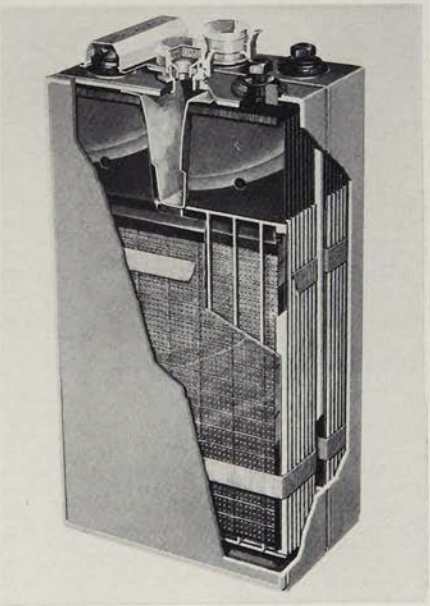
Increased NiCd battery reliability

New from Alcad Limited is the LBP, MBP and HBP series of rechargeable, nickel-cadmium (NiCd), pocket-plate, block batteries which are specially designed for applications where reliability is of prime importance.

The batteries feature all-welded internal connections which ensure high reliability and performance and improved discharge performance at intermediate and short discharge rates for the L and M types.

The LBP, MBP and HBP series is available in two cell widths, each of which comes in two heights. Block length varies between three and 10 cells.

NiCd batteries offer many advantages over lead-acid types in terms of servicing requirements, ease of transportation, resistance to electrical abuse and self-discharge rates.



Tracking system update

Racal Survey's SkyTrac tailbuoy tracking system has undergone a major upgrade. This has arisen through the SkyTrac operating system being changed from a 'position' domain to a 'pseudo range' domain which gives significant improvements in performance.

The new SkyTrac PR system uses the same hardware as the previous GPS tailbuoy tracking equipment but by operating in the 'pseudo range' domain it means that instead of sending 'position' information from the tailbuoy back to the vessel, individual satellite pseudo ranges are sent to the vessel from the tailbuoy. These are processed by the vessel's tailbuoy tracking computer in conjunction with similar information from the ship's GPS receiver to provide the range and bearing of the tailbuoy relative to the vessel. This new system eliminates the need for the vessel to control the satellite constellation of the tailbuoy's GPS receiver and reduces the amount of data interchange being sent over the telemetry link.

The SkyTrac PR system has been designed to track multiple seismic streamer tailbuoys using miniaturised GPS receivers combined with an intelligent radio telemetry system. This complements the existing Hyper-Fix and Pulse/8 II tailbuoy tracking systems to provide precise tailbuoy positioning anywhere offshore.

The new system is also suited to the tracking of ancillary vessels, such as anchor handling tugs, associated with offshore drilling rigs and construction activities. The first use of the system for this application will be to position the anchor handling tugs during the laying of the Trans Mediterranean pipeline.

Award for subsea booster

Kvaerner won the Offshore Northern Seas Innovation Award at the Stavanger exhibition for its development of a subsea booster breakthrough which will enable 20–30 percent more oil and gas to be pumped from the bottom of a well and transported.

It should mean that more smaller and medium sized fields, currently not worth developing in commercial terms, can now be brought into use as the oil or gas can be sucked up and delivered to the well-head at greater pressure.

A number of companies have been trying to develop systems for pumping and transporting unprocessed wellstreams but it has proved difficult to find the technical solution. The Kvaerner system has now achieved an important breakthrough by separating the stream into gas and liquid phases using separate pipelines to transport them to a platform or to an onshore site.

Downhole impact tool

A new double acting accelerator, for downhole impact tool technology is available from Weir-Houston Engineers (WHE).

The tool is an enhanced version of a model already successfully in use in the North Sea. The new equipment contains a number of design features at the leading edge of jarring technology, aimed at improving performance downhole.

The accelerator operates in conjunction with WHE's Hydra-Jar and forms part of the botton hole assembly. This impact system's purpose is to deliver a series of blows to free a drill string that has become stuck in the well. The main advantage of the new tool is that it can exert load to the Hydra-Jar in both directions. It is especially suitable for highly-deviated and sticky wells.

Emergency spill audit pack

3M is offering a free 'Hazardous Spill Response Audit Pack' to any organisation with a need to contain or clean-up potentially hazardous spills. Designed to encourage the implementation of more effective spill response procedures, the pack reflects the requirements of the Control of Substances Hazardous to Health (COSHH) regulations and helps to define how hazardous liquids should be contained, cleaned up and disposed of safely.

Precision tank testing

PM Services has launched a system to test fuel storage tanks and pipelines for leaks.

This precision test system uses innovative vacuum technology to detect leaks and provides significant benefits over traditional methods.

PM Services, a GEC company, has signed an exclusive agreement with Tanknology Corporation International of Houston, Texas to operate their patented VacuTect™ system throughout the United Kingdom.

Fuel leaks from underground storage tanks at filling stations and other sites are hazardous and create serious environmental problems which must be minimised by early and accurate detection.

Traditional methods of testing tanks use either liquid level measurement or pressure methods in an attempt to determine tank tightness. Basically, the Tanknology VacuTect system introduces a vacuum into the tank which causes air or water to be drawn in through any hole. This ingress is detected by highly sensitive instruments contained in a probe which has been lowered into the tank.

VacuTect is therefore non-volumetric — the tank does not need to be drained or over-filled as with most other methods — avoiding any risk of contributing to the leak or the problems associated with fuel removal.

It is unaffected by factors such as temperature changes, vapour pockets, pressure, vibration or equipment calibration accuracy, which can cause false readings with alternative methods.

Water ingress, a problem for volumetric methods, is positively identified and measured using VacuTect.

Contact List

Alcad Limited	0527 585351
Houston Atlas distributors:	
Hobre Instruments (UK) Ltd	0249 444133
3M Occupational Health Group	0800 212490
Ingersoll-Rand	0800 282040
The Weir Group Plc	041 637 7111
Racal Survey Limited	0734 669969
Environmental Resources Limited	071 465 7200
Kvaerner AS	+47 2 96 70 00
PM Services	0483 770143
Ginge-Kerr Offshore AS	(04) 80 08 60
Jiskoot	0892 518000

Water replaces halon in firefighting technology

An environmentally-friendly fire fighting technology to replace halon is ready to be introduced by BP, Svenska Petroleum and Ginge-Kerr Offshore.

Halon gas has been identified as an agent in the depletion of the earth's protective ozone layer against incoming infrared radiation. But halon gas is widely used in fire-fighting systems for protection of highly sophisticated equipment; such as computers, electrical switch gear, machine rooms, gas turbines to name a few. Halon is efficient, inexpensive to use, and harmless to people working in the protected area.

BP Research, at Sunbury has for the last five years developed a fine water spray system, which has been demonstrated to be a highly effective fire-fighting method and an alternative to halon. The fine water spray technology uses twin fluid (air and water) spray nozzles, under low pressure to generate an extremely fine water mist. It will extinguish a 1 megawatt diesel pool fire in seconds with half a cup of water.

BP Norway Ltd has taken the lead in removing halon at their fields, Ula and Gyda. The last halon systems will be removed before the end of 1993, well before 1 January 1995, when all halon systems must be taken out of service in Norway.

. . . people

Mr John Paul Jones, above, has been appointed General Manager, overseeing Wood Group Production Technology's activities in the United Kingdom and international markets. Mr Jones has ten years oil industry experience gained in the United States and holds a BSc in Petroleum Engineering from Texas A&M University.

Mr Nigel Rayner has been appointed Manager — Testing and Production Services reporting to Mr Jones, with responsibility for the management and expansion of the company's business unit in the North Sea and overseas locations.

Petroleum Exploration Computer Consultants (PECC), the information technology services company, has appointed **Dr Ugur Algan** as its Technical Director.

Mr Mike Turner, below, has been appointed as Petroleum Sales Executive for sign designers and manufacturers AC Edwards plc, reporting to **Mr Peter Franklin,** Sales and Marketing Director.

Mr Finn Kulås has been appointed the new Managing Director of Statoil (UK) Ltd, succeeding **Mr Willy Olsen.** Mr Kulås was previously Executive Vice President of the Statoil Petrochemicals division in Norway. His background includes positions as Director Research and Development and later Vice President of Marketing in Saga Petroleum, as well as Managing Director of Statoil Petrochemicals in Sweden.

Mr Olsen is returning to Statoil in Norway as a Vice President with responsibility for Statoil's Exploration and Production in Europe and the former Soviet Union.

Mr Dean Mahony Senior Welding Technician at Head Robinson Engineering Limited, has been promoted to Production Manager. He joined the company three and a half years ago having served his apprenticeship with Strachan & Henshaw.

Mr David Byers has been appointed a Director of PROSPEX Limited, with responsibility for business development. He was previously General Manager of Corporate Development at Clyde Petroleum plc.

Mr Ewan Hunter, centre, with Park Brown Director's Mr Albert Brown, left and Mr Les Park, right.

Oil industry corporate consultants, Park Brown International, have appointed **Mr Ewan Hunter** to their management team. Mr Hunter joins Park Brown International as Principal Consultant from PR Consultants Scotland where he spent three years as Account Director and Head of the company's oil and gas division.

Scottish Enterprise's Regional Energy and recently formed Power Generation Teams, both based in Glasgow, will link with the Oil and Gas Group to form a new energy group headed by **Mr Mike Fleming.**

The new group has been formed to meet the changing needs of the energy industry at home and in export markets and will bring together 14 specialists from all areas of the energy industry.

Mr Christopher Chaloner has been appointed Director of Pict Petroleum plc. Mr Chaloner is Executive Manager, Business Planning of Amerada Hess Limited which holds 48.4 percent of the shares of Pict.

Mr Graham Harris has been appointed Managing Director of Foster Wheeler Petroleum Development Limited. He succeeds **Mr Peter Pearson** who has retired. He will also be joining the Board of Foster Wheeler Energy Limited.

Mr Timothy Forbes, below, has been appointed head of Total Oil Marine's development and planning division. Mr Forbes, previously deputy of the division, has been with the Total Group for 17 years, including Paris and Middle East offices, and has previously headed up financial and commercial functions of Total Oil Marine.

Mr John Auld, above, has been appointed Managing Director of Kuwait Petroleum (GB). He takes over his new position from **Mr Brian Stanley,** who has recently been appointed Managing Director of Kuwait Petroleum (Denmark). Mr Auld was previously Managing Director of Kuwait Petroleum International's aviation company. Prior to joining the Kuwait Petroleum group of companies in 1987, Mr Auld was Managing Director of Ultramar.

Mr John Batchelor, below, has been appointed Chief Executive of the Offshore Petroleum Industry Training Organisation, succeeding **Mr Jim Turner,** who retired earlier this year. During a long career with BP, Mr Batchelor held a number of senior management positions, both in the UK and overseas with specific responsibilities for joint ventures involving other oil companies and governments. His final appointment, before joining the United Kingdom Offshore Operators Association as Director-Aberdeen, was Chief Representative and General Manager for BP in Egypt.

Institute News

Around the Branches

Edinburgh and SE Scotland
5 October: 'Batch Control — the way ahead', J Houston, Fischer Control.
5 November: 'The THORP Project', M Bullock, Chief Engineer, THORP Division, BNFL.

Essex
14 October: 'Integrated pollution control', A Whitfield, HM Inspector of Pollution, Eastern Region.
11 November: Ladies evening 'Bread and cake making', J Scott, Bakery Manager, ASDA Stores Ltd.

Humber
8 October: 'The tioxide acid neutralisation project', Miss D Linton, Process Engineer, Tioxide Europe Limited.
30 October: Annual Dinner Dance.
26 November: 'Installation of the living quarters on Conoco's BA platform', J Tonge, Conoco UK Limited.

Irish
29 October: Evening meeting 'Bitumen — What is new?'
12 November: Annual Dinner.

London
22 October: 'Control of gasoline vapour emissions: an alternative approach to vapour recovery', DS Rulison, BP Oil.
10 November: 'I am/was a graduate'. P Gaffney, Gaffney Cline and Associates.

Midlands
14 October: 'Total Quality Management', T Chandler, Quality Consultant.
11 November: 'Background and Implementation of BS7750 Environmental Standard', presentation by BSI.

North-East
9 October: Branch Dinner.
20 October: 'Ground water remediation beneath petroleum and chemical plants', K Tierney, Hydrotechnica Ltd.
3 November: 'Tank calibration by laser techniques', T Denver, SGS Redwood Ltd.

Shetland
13 October: 'Training for a Changing World', R Edmondson, Institute of Petroleum.
13 November: Annual Dinner.

South Wales
20 October: 'Removal of sub-surface hydrocarbon pollution', G Licence, Miller Environmental.
19 November: 'Explosives awareness', K Callaghan, Ministry of Defence.

Yorkshire
13 October: 'The Institute of Petroleum — The Way Forward', I Ward, Director General, The Institute of Petroleum.
10 November: 'Environmentally Friendly Lubricants', RJC Biggin and AR Barber, Lubrizol Ltd.

Benevolent Fund

The Institute of Petroleum has a Benevolent Fund for the provision of financial and other relief or assistance to necessitous persons who are or have been members of the Institute and the necessitous 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 necessitous persons, even if their membership of the Institute has ceased, they are asked to inform Ian Ward 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.

New Collective Members

Bureau Veritas SA
17 Bis, Place des Reflets, La Defense 2, 92400 Courbevoie, France. Telephone: 142 91 54 93. Fax: 142 91 53 98
IP Nominated Representative: Mr J D Foster, Director Petroleum Services.

Bureau Veritas is a privately owned inspection company, with many affiliate companies around the world. A specialised department within the company's commodities and international trade branch is staffed by experts dealing specifically with the control, quantity and quality inspection of crude oil, petroleum products, LNG/LPG, chemicals, petrochemicals and allied products. The group is structured into five main branches: marine, industry, commodities and international trade, civil and environmental engineering, aeronautics and space.

United World Trade (UK) Ltd
163/169 Brompton Road, London SW3 1PY. Telephone: 071 225 0535.
IP Nominated Representative: Mr Joel H Davis, Director of Marketing.

United World Trade (UK) Ltd is a subsidiary of United World Trade Inc (USA), based in Denver, Colorado. The company also operates in Hong Kong and Moscow and is a term and spot contract seller of crude oil and products.

Veeder-Root Environmental Systems
Hydrex House, Garden Road, Richmond, Surrey TW9 4NR. Telephone: 081 392 1355.
IP Nominated Representative: Mr P B Whitehead, Managing Director.

Veeder-Root Environmental Systems is a subsidiary of Veeder-Root Company, Connecticut, USA. Operating throughout Europe, the company manufactures and supplies tank gauges, stock reconciliation and leak detection systems to the retail petroleum industry.

New Members

Mr EK Anderson, 1E, GF On Lee, 2 Mount Davis Road, Hong Kong.
Dr D Appah, Dept of Petroleum Engineering, University of Port Harcourt, PMB 5323, Port Harcourt, Nigeria.
Miss CE Baker, 68 Norbiton Avenue, Kingston upon Thames, Surrey KT1 3QP.
Mr SKR Bishop, 5 Hadley Wood Road, Kenley, Surrey CR8 5LY.
Mrs MC Campbell, The Bungalow, Sunnyside, Maryculter, Aberdeen AB1 0BT.
Mr AJ Corr, Arthur Andersen, 1 Surrey Street, London WC2R 2PS.
Mr S Crowe, Alfa-Laval Oil Field, Unit 6 Wellheads Road, Farburn Ind. Estate, Dyce, Aberdeen AB2 0HG.
Mr WP Donaldson, 47 Fairfield Rise, Billericay, Essex CM12 9NP.
Dr A Dosunmu, 4 Barthurst Street, PO Box 3723, Port Harcourt, Nigeria.
Mr GD Dryden, Unocal Thailand Ltd, 1693 Phaholyothin Road, Bangkok 10900, Thailand.
Mr CJ Falconer, Donray, Roadside, Kinneff, Montrose, Angus DD10 0TB.
Prof AR Forrester, University of Aberdeen, Regent Walk, Aberdeen AB9 1FX.
Mr S Forster, Inspectorate Casella Env Ltd, 4 Floral Place, Northampton Grove, Canonbury, London N1 2PL.

Institute News

Mr A Ganesan, 3/24 K.A.S. Road, Amar Villa No 2, Matunga, Bombay 400019, India.
Mr DC Godfrey, NIPA Laboratories Ltd, Llantwit Fardre, Pontypridd, Mid Glamorgan CF38 2SN.
Mr A Godman, Maitlands, Down Lane, Frant, Tunbridge Wells, Kent TN3 9HP.
Mr AR Gwinnutt, Courtaulds Engineering Ltd, PO Box 11, Foleshill Road, Coventry CV6 5AB.
Mr PV Hadley, 78 Burges Road, Thorpe Bay, Southend on Sea, Essex SS1 3HU.
Mr PP Hall, Brown & Root (UK), 150 The Broadway, Wimbledon, London SW19 1RX.
Mr RC Hamer, Finance, The Bank of Nova Scotia, Scotia House, 33 Finsbury Square, London EC2A 1BB.
Mr JC Herbert, 24 Ladbroke Drive, Walmley, Sutton Coldfield, West Midlands B76 8SD.
Mr PCS Hilferty, 5 Queens Gardens, Aberdeen AB1 6YD.
Ms M Hudnall, Dr Augustus Voelcker & Sons Ltd, 380 Bollo Lane, Acton, London W3 8QU.
Mr P Hutchison, 4 Troon Close, Bedford MK41 8AY.
Mr F Innes, Petroline Wireline Services Ltd, Howe Moss Tce, Kirkhill Ind Est, Dyce, Aberdeen AB2 0GR.
Mr RR Kreecke, Price Waterhouse, PO Box 881, 3000 AW Rotterdam, Netherlands.
Mr AR Krok-Paszkowski, Gulf Oil Poland, Al Jerozolimskie 11/19, 00 508 Warszawa, Poland.
Mrs E Kyriakides-Christodoulides, 18A Fulwood Gardens, Twickenham, Middx TW1 1EN.
Mrs BD Lafrenz, Quimex Ltd, 1 Norland Place, London W11 4QG.
Miss N Laird, AMOA, 96 Bridge Road East, Welwyn Garden City, Herts AL7 1JW.
Pros SR Larter, NRG, Drummond Bldg, The University, Newcastle upon Tyne NE1 7RU.
Mr P J Le Huray, W S Atkins Quality & Safety Management, Woodcote Grove, Ashley Road, Epsom, Surrey KT18 5BW.
Mr AB Lopez, Atlas Industries Sdn Bhd, PO Box 7005 Shah Alam, 40700 Selangor, Malaysia.
Mr M Lovett, Muse, Stancil & Co, No 3 Berkeley Square, London W1X 5HG.
Mr CB Manderson, ASCO, PO Box 167, Regent Centre Regent Road, Aberdeen AB9 8UQ.
Mr T Matovu, 44 Manship Road, Mitcham, Surrey CR4 2AZ.
Mr G McRobb, Petroline Wireline Services Ltd, Howemoss Tce Kirkhill Ind Estate, Dyce, Aberdeen AB2 0GR.
Mr MA Mian, Al-Mahmood, 89-C Hasilpur, Distt. Bahawalpur 63000, Pakistan.
Mr PB Moore, Samarec Review, Saudi Arabian Mktg & Refining Co, PO Box 5250, Jeddah 21422, Saudi Arabia.
Mr CW Nkhoma, Zimoil Divn (Zimco Ltd), PO Box 71588, Ndola, Zambia.
Mr C Noordam, CMG, Westblaak 226, Rotterdam 3012 KP, Netherlands.
Mr CM Oversby, 13 Corrichie Place, Banchory, Kincardineshire AB31 3WB.
Mr D Putnik, Transtech (Europe) Ltd, QA Divn Operation Office, Medserv Base, Manoel Island, Malta.
Mr S Ray, SGS India Pvt Ltd, SGS House Pvt Ltd, Naorojifurdomji Road, Colaba, Bombay 400039, India.
Mr PJ Redman, Prodrill Ltd, 7 Bon Accord Square, Aberdeen AB1 2DJ.
Mr B Restell, 25 Woolifers Avenue, Corringham, Stanford-Le-Hope, Essex SS17 9AU.
Mr J Risley, 14 Kipling Way, Harpenden, Herts AL5 4XG.
Mr J Sannes, Exploration & Production, Statoil (UK) Ltd, Swan Gardens, 10 Piccadilly, London W1V 9LA.
Mr P Shipman, Starform Communications Ltd, Heather Hse, Heather Gardens, London NW11 8HS.
Mr FJ Spann, 138 Puritan Road, Swampscott, MA 01917, USA.
Dr WY Tsiagbe, 79 Kingsway, Ponders End, Enfield, Middx EN3 4HT.
Mr P Van Den Engel, 123A Stock Road, Billericay, Essex CM12 0PR.
Mr R Voelcker, Dr Augustus Voelcker & Sons Ltd, 380 Bollo Lane, Acton, London W3 8QU.
Mr DJ Watt, 172 Bath Road, Southsea, Hants PO4 0HU.
Mr JP Williams, Flat B, 39 Birdhurst Road, South Croydon, Surrey, CR2 7EF.
Mr AG Wilson, Harrisons (Clyde) Ltd, 16 Woodside Crescent, Glasgow G3 7UT.
Mr I Winstanley, Parkes, Winstanley & Co, 294 Walkden Road, Worsley, Manchester M28 5FG.
Mr M Wong, 1 Purcell Avenue, Tonbridge, Kent TN10 4DP.
Mr NYH Wong, 245 The Vale, Golders Green, London NW11 8TN.

Student Prize Winners

Mr NJ Bruguier, 20 Petrel Way, Chelmsford, Essex CM2 8XH.
Miss NJ Prior, 81 Benhill Wood Road, Sutton, Surrey SM1 3SL.

Students

Mr A Adeniran, 215 Bellingham Road, Bellingham, London SE6 1EQ.
Mrs F Marbouh-Weill, 17 Belgrave Place, London SW1X 8BS.
Ms MZ McLean, Risefoot, Lune Close, Kirkby Lonsdale, Carnforth, Lancs LA6 2DA.
Miss OO Olatunji, 111B Mount Pleasant Road, London N17 6TQ.

UK Deliveries into Consumption

July 1992 — Tonnes

Products	*July 1991†*	*July 1992**	*Jan–July 1991†*	*Jan–July 1992**	*% change*
Naphtha/LDF	283,616	259,108	2,033,751	1,907,625	−6
ATF—Kerosine	652,250	674,944	3,402,636	3,827,255	12
Motor Spirit	2,152,699	2,100,138	13,885,326	13,921,988	0
of which unleaded	892,059	992,374	5,548,003	6,359,531	15
Super unleaded	106,044	127,104	650,018	799,241	23
Premium unleaded	786,015	865,270	4,897,985	5,560,290	14
Burning Oil	117,034	109,977	1,370,483	1,363,831	0
Derv Fuel	925,966	966,518	6,178,664	6,380,461	3
Gas/Diesel Oil	570,956	593,608	4,733,199	4,559,747	−4
Fuel Oil	938,967	880,203	7,188,362	6,571,802	−9
Lubricating Oil	67,728	71,617	448,389	471,522	5
Other Products	693,890	591,944	4,121,564	4,003,958	−3
Total above	6,403,106	6,248,057	43,362,374	43,008,189	−1
Refinery Consumption	527,050	506,704	3,502,327	3,482,537	−1
Total all products	6,930,156	6,754,761	46,864,701	46,490,726	−1

†Revised with adjustments *Preliminary

LONDON BRANCH

Control of Gasoline Vapour Emissions — An Alternative Approach to Vapour Recovery

By Dr D S Rulison, BP Oil International

at the Institute,
6.00 pm, Thursday, 22 October 1992.

Dr Rulison will describe the development and economics of an alternative approach to vapour recovery for the reduction of vapour emissions during the storage and handling of petroleum products. The technique involves the containment of fuels in collapsible bags inside storage tanks and road tankers. By segregating the product from the workplace and the environment, the formation of volatile emissions is avoided, thus eliminating the needs for their recovery.

The meeting is preceded by tea and biscuits at 5.15 pm and is followed by light refreshments.

Enquiries: Mrs E Walker, Hon Secretary, London Branch, Tel: 0926-404257.

The Institute of Petroleum

LIFE CYCLE ANALYSIS AND ECO-ASSESSMENT IN THE OIL INDUSTRY

Thursday 26 November 1992

A one-day Conference to be held at The Cavendish Conference Centre, London

The oil industry is accustomed to paying great attention to the energy balances of both new and existing processes since refinery energy has always been a key element of a downstream company's cost structures. Now, however, it is not merely consumed energy which is at issue but the pollution and waste created during the integrated activities from well-head to final use and/or disposal of the oil product.

The use of Life Cycle Analysis (LCA) or Cradle-to-Grave Analysis to assess the total environmental impact of products or activities is still in its infancy. Nevertheless, LCA is an essential tool in the investigation of products seeking an 'eco-label'. Although some oil products are held as too dangerous to be considered for eco-labelling as such, the LCA techniques for assessment and comparison of the different oil products are of critical importance in guiding the decision-making processes both at the energy/environment interface and in the product formulation.

This conference will examine the general status of LCA and its relevance and application in the oil industry both in the context of the European Commission's Eco-labelling Directive proposals and the environmental impact of automotive fuels and lubricants.

For further information, and a copy of the registration form, please contact
Caroline Little, The Institute of Petroleum,
61 New Cavendish Street, London W1M 8AR.
Telephone: 071 636 1004. Telex: 264380. Fax: 071 255 1472

IMPLICATIONS OF BIOCIDE USE WITHIN THE PETROLEUM INDUSTRY

12 November 1992

To be held at

The Institute of Petroleum, London

Chairman: Mr PJ Ruane, Castrol Technology Centre

Presentations will include:

Overview — Biocides Boon or Bane?
Mr EC Hill, ECHA Microbiology Ltd

Industrial Applications
Dr BN Herbert, Shell Biosciences Laboratory, Sittingbourne Research Centre

Three manufacturers will give papers on the use of their products:
Mr W Siegert, Schulke and Mayr GmbH
Dr M Wooder, Rohm and Haas UK Ltd
Dr B Backhouse, SHE Department, ICI Specialty Chemicals

Biofilms
Ms S Kinnimet, School of Pure and Applied Biology, University of Wales

Environmental Impact of Biocides
Dr M G Ford, School of Biological Sciences, University of Portsmouth

Toxicology of Biocides and Regulations
Dr A Saleem, Pesticides Registration Section, Health and Safety Executive

For further information, and a copy of the registration form, please contact **Caroline Little,** The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK. Telephone: 071-636 1004. Telex: 264380. Fax: 071 255 1472.

The Institute of Petroleum

OFFSHORE SUPPLY VESSELS: Regulatory, Commercial & Operational Issues

Thursday 22 October 1992

To be held at

The Cavendish Conference Centre, London

The Opening Address will be given by Lord Caithness, Minister for Aviation and Shipping, Department of Transport

Other presentations will include:

UKOOA/BOSVA Code of Practice for Support Vessel Operations
Captain J Middleton, Marathon Oil, Aberdeen

The Supply Vessel Market — An Overview
Mr R Shepherd, Managing Director, Petrodata Ltd, Aberdeen

The Supply Vessel Market — An Owner's View
Captain RDM Lenthall, Executive Chairman, Marine Services Sector, Ocean Group plc

Supplytime Charter
Mr J Hojer, Deputy Secretary General, BIMCO, Denmark

Cargo Handling
Captain VR Gibson, Notac Ltd

Anchor Handling
Captain M Negus, Operations Manager, Noble Denton Marine Services Ltd

Modern Supply Ship Design
Mr R Emblem, Maritime Engineering AS, Norway

Development in Anchor Handling and Deck Equipment
Mr T Gjosund, Ulstein Brattvag AS, Norway

For further information, and a copy of the registration form, please contact **Caroline Little,** The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK. Telephone: 071-636 1004. Telex: 264380. Fax: 071 255 1472.

CONSULTANT LIST

Members of the Institute of Petroleum offer consultancy services in a wide range of petroleum industry subjects. Currently about 400 members offer 52 different categories of expertise.

A handbook of all consultants indexed by category is available from the Institute for £12. (Payment by cheque or credit card with the order.)

Alternatively a list of consultants in any category will be provided free of charge on application (maximum two categories).

Additives Technology
Corrosion Technology
Custody Transfer Arrangements
Energy Efficiency
Environment — General
Environment — Marine Pollution
Expert Witness Services
Finance
Fuels & Fuel Technology
Government & EC Relations
Health and Hygiene
Heat Transfer
Industrial Relations
Information Technology
Laboratory & Test Method Advice
Legal Advice
Loss Prevention
Loss Prevention — Marine
Lubricant Technology
Maintenance & Inspection
Management Organisation
Marine Operations
Market Research & Analysis
Marketing — General
Marketing — Operations
Measurement & Fluid Flow
Microbiology
Oil/Gas Economics & Pricing
Oil & Gas Explorations
Oil & Gas Production
Oilfield Chemicals
Oilfield Development
Oilfield Machinery & Equipment
Oilfield Sub-sea Development
Petrochemicals
Petroleum Information Services
Pipeline Planning & Management
Planning & Economics
Plant Design
Project Services & Engineering
Public Relations
Quality Management & Assurance
Refinery Operations
Risk Analysis
Risk Analysis — Financial
Safety
Site Selection & Investigation
Supply & Distribution
Technical Writing
Telecommunications & Networks
Trading & Shipping
Training

Anyone interested should contact Jo Howard-Buxton at the IP, or send a request for the handbook, together with cheque/credit card details to: Technical Department, Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR.
Tel: 071 636 1004 Fax: 071 255 1472