Image: Description of the institute of petroleum May 1997





Annual IP Introduction Courses 1997

The Institute of Petroleum's annual three day non-residential general introduction courses to the oil industry have proved very successful and will be repeated again this June. Each course is self-contained but many participants will find it advantageous to attend both courses, in which case a special combined registration fee is available at a reduced rate.

The courses are particularly valuable for:

- Participants from within the oil industry who require a broader perspective of the industry's activities and the economic factors affecting its development
- Participants from financial and commercial companies, supply and service sectors and government organisations who require an informed and concise introduction to the economic and commercial background of the oil industry.

Introduction to Oil Industry Operations Course London: Wednesday 18 – Friday 20 June 1997

This course provides a concise and informed introduction to operations, from the search for oil and gas to the delivery of products to different customers. Participants will gain an appreciation of the principal activities in the international upstream and downstream petroleum industry and an understanding of how these interrelate, as well as an appreciation of the impact of external influences and the ways in which the industry is adapting to increase its competitiveness and to meet the many new challenges.

This is a self-contained course but is followed by:

Introduction to Petroleum Economics Course London: Monday 23 - Wednesday 25 June 1997

This course is designed as an informed introduction to petroleum economics, concentrating on the structure of the oil industry, the geopolitics of oil and the working of the principal markets. The course is presented by a team of lecturers all of whom have considerable recent experience of the industry and are practised in teaching and lecturing on these subjects.

For copies of the programme and registration form, please contact: Pauline Ashby, The Institute of Petroleum, London W1M 8AR TEI: 0171 467 7100 Fax: 0171 255 1472

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The Institute of Petroleum as a body is not responsible either for the statements made or opinions expressed in these pages.

Those readers wishing to attend future events advertised are advised to check with the contacts in the organisation listed, closer to the date, in case of late changes or cancellations.

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COVER PHOTO E & P activity onshore Egypt Map drawn by Emma Parsons

News in Brief_

19 March

A joint venture comprising Ranger Oil, Clyde Expro, Gentry Africa, Energy Resources, TC Petroleum and Petroci has signed a production sharing agreement with the government of Côte d'Ivoire covering offshore block CI-102 which lies between the Espoir and Belier oilfields. Ranger Oil holds a 24 percent interest in the project, as do Clyde and Energy Africa, and will act as operator.

20 March

Argentinian authorities have ordered the closure of 112 oil wells operated by YPF as a result of spills that have polluted the Colorado River in the southern Mendoza and Neuquen provinces, reports *Lloyd's List*.

21 March

Nuevo Ghana Inc and Yukong Ltd have entered into a petroleum agreement with the government of the Republic of Ghana and the Ghana National Petroleum Corporation covering exploration and production operations in the offshore Eastern Cape Three Points area.

Esso Production Malaysia Inc

has signed two new production sharing contracts with Petronas, Malaysia's national oil and gas company. The contracts cover two highly prospective blocks, SB302 and H which include new deep water acreage offshore the state of Sabah.

24 March

BP Solar has signed a \$30 million, three-year contract with the Philippines government to design, supply and install more than 1,000 solar systems in over 400 villages in the Visayas and Mindanao regions. The solar packages will be manufactured at the company's factory in Sydney.

Dana Petroleum (Ghana) Limited has entered into a petroleum agreement with the government of the Republic of Ghana and the Ghana National Petroleum Corporation. The agreement, which provides for the exploration, development and production of petroleum in a contract area of 2,341 square kilometres offshore western Ghana, is expected to be ratified by the Ghanaian government during the next three months.

25 March

Petergaz - a joint venture between Gazprom and OII and Heerema Gas Development - is to manage the offshore section of a pipeline link across the Black Sea running between Djubga in Russia and Samsun in Turkey. More than 16 billion cubic metres of gas will pass through the 400-km pipeline section per year. First gas is expected to flow by the year 2000. A feasibility study of the project is scheduled to be completed in July.

Pogo Producing Company reports that three exploratory

wildcat wells drilled in the Benchamas North structure in the Gulf of Thailand have encountered a number of prospective oil and gas sands but only modest accumulations of hydrocarbons. However, evaluation of the area continues in anticipation of future drilling, states the company.

M-I Drilling Fluids of Houston,

Texas has acquired Denver, Colorado-based Summit Drilling Fluids. Revenues for Summit were in excess of \$10 million for 1996.

28 March

Deutsche Tiefbohr (Deutag) has secured a contract from Amoco for a single new extended reach well to be drilled a few miles from BP's Wytch Farm. The horizontal step-out under the sea will be more than three kilometres.

Phillips Petroleum Company

Norway has awarded a fiveyear extension of its contract with Deutag Norge Drilling for production drilling services in the Greater Ekofisk Area. The extension is worth NOK360 million.

31 March

Ownership of Aberdeenbased MacGregor Energy Services Limited, which provides a range of integrated services to oil and gas operators, drilling companies and contractors, has been transferred to an enhanced management team and institutional investor 3i.

1 April

Tuskar Resources of Dublin has signed a Memorandum of Understanding with Camac International (Nigeria) Limited to acquire its net production revenue interest in the Ukpokiti field located on oil mining lease 108 offshore Nigeria. The fast-track project is due onstream this July and has an expected production life of seven years. Reserves are estimated at 32 million barrels. Peak production is expected to reach 20,000 b/d.

Arco has announced that it

is evaluating its likely withdrawal from its worldwide coal business through the disposal of coal mining operations in the United States and Australia. The overall process is expected to take at least six months.

Conoco reports that its Humber refinery is to shut for major maintenance next month. The £20 million 'spring clean' will take five weeks, with the refinery shut down for 17 days.

2 April

Pentland Aviation Fuelling Services Ltd has awarded Simon Aviation the contract to manage, maintain and operate its facilities at both Glasgow and Edinburgh airports. Simon will handle some 180 million litres of fuel per year at Glasgow and 90 million litres at Edinburgh.

Esso Production Malaysia Inc has started production and sales from the Lawit gas

field, located 240 km offshore Terengganu, Malaysia. The company reports that the field is capable of supplying about one-third of Peninsular Malaysia's gas requirements.

3 April

Gazprom and German utilities Ruhrgas and Preussen have acquired a third of Latvia's gas company for some \$50 million, reports the *Financial Times*. Further investment by the German consortium is expected later this year.

Repsol has made a new discovery of gas and condensate on the Khalda concession in Egypt. The Shams-2X discovery well produced some 20,000 barrels of oil equivalent per day during testing.

Norsk Hydro is to sign a Letter of Intent with Aker Stord and Aker Verdal for two engineering, procurement and construction contracts for the deck and jacket for the Oseberg Sør platform, as well as hook-up of the field which is due onstream in the year 2000.

Weatherford UK Ltd has been awarded two, two-year contracts for fishing, casing running, abandonment and drilling tool services for the UK operations of Texaco North Sea.

Texaco has renewed its UK fuels distribution contract with Wincanton Logistics for a further three years. The haulier distributed some 2.3 billion litres of fuel to Texaco service stations and commercial customers in the United Kingdom last year.

Esso (Tianjin) Company Limited and Esso (Zhejiang) Company Limted have announced plans to construct their first two lube oil blending plants in the People's Republic of China. Each will have a capacity of 250,000 barrels per year.

4 April

British-Borneo Petroleum Syndicate reports that its exploration well Green Canyon 37#1 in the Gulf of Mexico encountered approximately 160 feet of net hydrocarbon sand and recovered oil samples of 8.6° API from a high quality reservoir.

News in Brief

BP and construction company Bovis have formed a five-year alliance that will see the latter building and maintaining the oil company's retail sites in Europe. Under the terms of the agreement, Bovis will derive its profit solely from any savings it achieves. At least 150 new service stations are to be built by end-1997.

The Pipeline Industries Guild has announced that the 1996 award for the most significant contribution to subsea pipeline technology has been won by Copipe Systems of Aberdeen for its development of the technique and equipment required to carry out vessel-based vacuum drying of subsea pipelines. The company carried out the world's first such project on the 8-inch Teal-Guillemot gas export pipeline in 1996, vacuum drying the line to better than -20°C dewpoint from the vessel Norlift.

7 April

The Petroleum Engineering Department at Heriot-Watt University has won first prize in the Office of Science and Technology Competiton for I n d u s t r y - A c a d e m e Collaboration.

Russian Fuel and Energy Minister Pyotr Rodionov has tendered his resignation to return to the private sector, according to *Energy Day*.

Astra, controlled by Repsol

and YPF, has acquired the full 67 percent interest that Mexpetrol SA held in Mexpetrol Argentina for an undisclosed sum. Once the deal is completed, Astra will control 66.5 percent of Mexpetrol Argentina's capital and will take over operation of the Portón Buta Ranguil oilfield in which Mexpetrol holds a 50 percent stake. The remaining 33.5 percent of capital will remain with YPF which also controls 50 percent of the oilfield.

North Sea Producer, the MacCulloch field's floating production vessel, has taken up station in the field. Statoil has commenced appraisal drilling the first well in its 1997 Irish drilling programme in block 26/28 in the Connemara field in the Porcupine Basin.

8 April

UK-based oil and gas exploration company Melrose Energy has sold its oil and gas businesses and US interests for some £13.6m, reports the *Financial Times*. The company has also changed its name to Pentex Energy.

Petrofina has announced its fifth discovery offshore Vietnam, according to *Lloyd's List*.

Lasmo reports that its Bhit-2 exploration well in the Kirthar concession in Western Sindh, Pakistan has confirmed the substantial reserves potential of the Bhit gas field. The well tested at a cumulative flow rate of 17.7 mncuft/d. Consideration of development options for the Bhit discovery have already started, states the company.

Elf reports that appraisal well Girassol 2A on block 17 offshore Angola has tested at a cumulative daily flow rate of 18,000 barrels of oil on two reservoirs of good quality.

10 April

The Monopolies and Mergers Commission inquiry into Ofgas' proposed price controls on TransCo has been extended by some six weeks until 31 May.

Shell UK Exploration and Production has extended by a month the deadline for the delivery of bids from the six contractors and consortia competing to develop alternative solutions for the disposal of the Brent Spar. The new deadline is now 2 June.

British-Borneo Petroleum Syndicate has concluded an agreement with Vastar Resources on Garden Banks Block 258 in the Gulf of Mexico. The agreement enables Vastar to earn a 30 percent working interest in the block, which contains the Kilmarnock prospects, down to the depth drilled in the initial exploratory well.

Ranger Oil has acquired an

additional 20 percent interest in the Ranger-operated Kyle oilfield in the North Sea from Mobil.

11 April

The contract for the design, systems engineering, fabrication and delivery of the complete subsea hardware package for Woodside's Laminaria and Corallina fields in Australia has been awarded to Kvaerner by the Coflexip Stena Kenny joint venture.

Statoil has awarded the NOK850m contract to lay the Europipe II and Ekofisk Bypass gas pipelines to Allseas Marine Contractors. To be installed during 1998 by the newly built laybarge *Solitaire*, Europipe II will run for some 630 km from the Karstø gas treatment plant north of Stavanger to Dornum on the German coast, while the Ekofisk Bypass will connect the Statpipe and Norpipe gas trunklines directly.

14 April

Halliburton Energy Services has been awarded a five-year contract by Shell UK Exploration and Production and NAM for the management and delivery of completion equipment. The new contract is valued at some \$120m. Equipment will be supplied to Shell Expro's northern and southern oil and gas developments in the UK sector and NAM's onshore and offshore developments in the Netherlands. A division of South Korea's LG Group has secured a \$100m contract to design and build a liquefied natural gas storage facility in southern China for Caltex Corp.

15 April

Tunisian President Zine El Abidine Ben Ali inaugurated BG plc's Miskar gas field in the Gulf of Gabes. The field entered full production in June 1996 and now delivers some 80 percent of Tunisia's natural gas.

Russia has signed a deal with Iraq's parliament to develop the large Qurna oilfield in southern Iraq, according to the *Financial Times*. However, no progress is likely until the UN sanctions against Iraq have been lifted.

16 April

BG Exploration & Production reports that its first exploration well in the Rosetta concession area offshore Egypt has tested in excess of 60 mncuft of gas per day. The gas is of very high quality with less than one half of one percent impurities.

18 April

Aqumen Group has secured a £2.5m contract to provide total facilities management for Phillips Petroleum Company UK Ltd's headquarters and two satellite premises at Woking.

21 April

Total and its Vietnamese partner Tradimexco have been authorised by Vietnam's Ministry of Planning and Investments to create a joint venture to import, store and market LPG.

News in Brief Service

Keep abreast of the latest developments, deals and contracts in the oil and gas industry around the globe with *Petroleum Review's* new *News in Brief Service* on the Internet.

Access the regularly updated information, listed in chronological order, from the IP Home Page.

URL:http://www.petroleum.co.uk/petroleum/

Newsdesk

BG signs Trinidad production sharing deal

BG plc, Agip and Deminex have signed a production sharing agreement with the government of Trinidad and Tobago to open up a new hydrocarbon province off Trinidad's northern coast.

The North Coast Marine Area contains the undeveloped Hibiscus, Orchid, Iris and Poinsettia gas fields which have potential reserves of more than 3 trillion cubic feet of gas.

BG will act as operator. Further exploration activity is currently underway and two exploration wells will be drilled within the next six months.

The primary market for the North Coast gas is the potential expansion of the Atlantic LNG Company of Trinidad and Tobago's liquefied natural gas plant at Point Fortin. BG is major shareholder in the company with a 26 percent interest. The \$1 billion export plant, now under construction, is scheduled to come onstream in winter 1998-99. Sales agreements for the 3 million tonnes of LNG annual output have been signed with Cabot for markets in northeastern United States (60 percent) and Enagas for sales in Spain (40 percent).

Green light for Viking satellites

The UK government has given co-venturers Conoco and BP the green light to develop further reserves in the Viking gas fields in the southern sector of the UK North Sea.

The four reserves – two of which, F and Fs, are part of the Viking 'A' field, the other two, Gn and Wx, forming part of the Viking 'E' field – are located in blocks 49/12a and 49/17 some 100 km east of the Lincolnshire coast. They contain recoverable reserves of approximately 500 billion cubic feet of gas, first production of which is expected in the fourth quarter of 1998.

Two not-normally-manned platforms will be used to develop the reserves – one tapping F and Fs, the other Wx and Gn. Gas from F/Fs will flow through a 15-km, 16-inch diameter flowline to the Viking 'B' platform complex. A subsea tee will be used to connect the Wx/Gn platform to the flowline. Gas from all four reserves will be transported from Viking 'B', through the existing Viking transportation system, to the Theddlethorpe terminal.

Six wells will initially be required to develop the reserves. Four will be drilled before first gas and two existing appraisal wells will be converted to producers. Combined production is expected to peak at around 300 million cubic feet of gas per day.

United on the European metering front

A new association uniting energy suppliers, accounting specialists and meter manufacturers in the interests of fair energy accounting according to consumption has been established in preparation for the liberalisation of Europe's energy markets.

One of the tasks of the European Automatic Meter Reading Association, known as EuroAMRA, will be to find solutions for the more efficient use of resources, improved customer services and optimised dealings with supply companies. It will also be responsible for the introduction of European meter standards and fully automated reading technologies.

Some 17 companies and organisations from six European countries are involved in the new association which was inaugurated at Raab Karcher Energy Services' headquarters in Essen, Germany, earlier this year. EuroAMRA already has British and American counterparts, UKAMRA and AMRA, the latter operating in the United States since 1986.

Go-ahead for three UK gas field projects

The UK government has given the green light for the development of three high pressure, high temperature gas condensate fields – Elgin, Franklin and Shearwater – in the central North Sea.

The Elgin field, located 225 km east of Aberdeen, will consist of a seven-well development with its own wellhead while the Franklin field, some 6.5 km southeast of Elgin, is expected to have five production wells tied back to a not-normallymanned wellhead platform.

Condensate fluids from both fields will be processed through a permanently manned process, utilities and guarters platform located at Elgin. Gas will be transported by a new 34-inch, 463-km pipeline to Bacton, Norfolk, where it will be sent to the TransCo National Transmission System and to the Bacton-Zeebrugge gas interconnector. Named the Shearwater and Elgin Area Line (SEAL), the £400 million pipeline will be the longest on the UK Continental Shelf.

Construction of the 922 million cubic feet (mncuft) of gas per day capacity line is scheduled to begin in 1998 with first gas expected to flow in 2000.

Liquids, meanwhile, will be transported to shore via a new 24-inch spur line into a 'Y' piece near the Marnock field platform to the Eastern Trough Area Project pipeline from where it will proceed via the Forties system to Grangemouth in Scotland.

Both routes to shore will be shared by products from the nearby Shearwater field which is to be developed by between five and seven wells with condensate fluids processed through a process, utilities and quarters platform linked to a fixed wellhead platform.

Both the Elgin and Franklin fields have a 22year life span with estimated reserves of 889 billion cubic feet (bncuft) of gas and 244 million barrels of condensate from Elgin and 821 bncuft of gas and 123 million barrels from Franklin.

Estimated recoverable hydrocarbons in the 11-year life of Shearwater are 844 bncuft of gas and 159 million barrels of condensate and liquids.

First services on Kent motorway



The first service station on the M20 has opened at Junction 8 near Hollingbourne. The forecourt forms part of the Maidstone Motorway Service Area, a joint development between Esso and RoadChef.

Development of the site has taken over 10 years since options

were first taken out on the land. During that time, not only was it the subject of a legal dispute with the Highways Agency, work on the site was postponed last year to allow an archaeological dig to be carried out after some Bronze Age pottery fragments were found.

Newsdesk

Tullow Oil expands exploration and production portfolio

Tullow Oil has announced a number of recent licence awards and developments in its exploration and production portfolio.

It has entered into an agreement with Addax Petroleum (Côte d'Ivoire) Ltd to acquire, subject to certain conditions and government approval, a 36 percent interest in block C1-26 offshore the Ivory Coast. The block contains the Espoir field, discovered and developed by Phillips Petroleum in the 1980s prior to being abandoned as a result of low oil prices, less favourable economic terms prevailing at that time and strategic reasons. A technical and

economic study for the redevelopment of the field is currently being carried out.

Tullow also plans, with cooperation from Okland Oil Company and Rexwood Corporation, to pursue various oil and gas opportunities in Bangladesh. Okland and Rexwood were recently awarded offshore blocks 17 and 18 which lie adjacent to block 16 where Cairn Energy has made a significant gas discovery, Sangu, which is now being developed.

The company is also examining the prospect of improving the combustible quality of gas from the Sara West field in Pakistan in order to make the field commercially viable. It has also made arrangements to farm in to four exploration licences in India (three onshore, one offshore), one of which contains a small commercial gas discovery due to commence production shortly.

Meanwhile, Tullow has been awarded, as operator, the North Abu Rudeis block on the eastern bank of the Gulf of Suez. A well is expected to be drilled later this year. The company also reports that the development plan for the Kishma field in Syria has been approved and production is expected to start next quarter at an initial rate of 5,000 barrels per day.

New Canadian oil sands project

Shell Canada is to build a new commercial mining project in the Athabasca oil sands region of northern Alberta. The proposed \$1 billion mine and extraction plant to be constructed on Shell's lease 13 located some 70 km north of Fort McMurray will be Canada's largest new oil sands project to be developed in the past 25 years. The region is estimated to hold some five billion barrels of bitumen recoverable by surface mining methods.

The project will initially produce 120,000 barrels per day (b/d) of bitumen with startup scheduled for 2002. Output will be transported via a new pipeline to Edmonton.

Shell is currently assessing several technical and commercial options to upgrade the bitumen into synthetic products, including the construction of a new upgrader at Shell's Scotford refinery in Fort Saskatchewan, Alberta.

The company plans to file an application for the necessary regulatory approvals by the end of this year, following consultation with local communities, interested parties and regulatory agencies. If regulatory approval is received, it will initiate site preparation before the end of 1998.

Concern over Torres Strait pipeline

Aborigines and Torres Strait Island people are concerned over plans to build a A\$2 billion natural gas pipeline from Papua New Guinea to North Queensland by Chevron South Pacific.

The line will run 1,900 km from Lake Kutubu in the New Guinea Highlands through the Kikori River delta, across Torres Strait, and via Cape York Peninsula to Townsville, North Queensland.

Both the PNG and Queensland governments support the scheme. North Queensland conservationists claim, however, that the pipeline will damage wilderness areas in far North Queensland. Torres Strait islanders are concerned that their traditional seafood sources be protected when the pipeline is laid across Torres Strait.

Construction of the pipeline is scheduled to start in 1999 and be completed by 2001. The company plans to extend it south to Gladstone later on.

A Chevron technical manager said care would be taken to minimise damage when the pipeline was laid.

First phase plans for Bayu-Undan field

Participants in the Timor Sea Bayu-Undan gas condensate discovery have reached agreement on first phase plans for development of the field as a single unit. The agreement, which is subject to the approval of the joint authority which administers the area, also covers procedures to determine initial participating interests in the discovery and the naming of BHP Petroleum as operator.

First phase plans comprise production from an offshore gas recycling project producing condensate and liquid petroleum gas (LPG) with production start-up scheduled for 2001. Export of condensate and LPG will be via a floating storage and offloading facility.

It is expected that the offshore gas liquids recovery facility will subsequently be integrated with a liquefied natural gas (LNG) facility using either BHP's proprietary offshore technology Phillips Petroleum's or onshore Optimised Cascade Process. Final agreement on the choice of the LNG concept technology is expected shortly. On start-up of the LNG facility, surplus produced gas will continue to be recycled to enhance recovery of liquids.

Obituary

G H Herridge CMG, FinstPet Geoffrey Herridge joined the Turkish Petroleum Company, later to become the Iraq Petroleum Company (IPC), in 1929 straight from St John's College, Cambridge . He spent his early years with the company in Iraq, having joined the Baghdad office before oil was discovered in commercial quantities, and transferred to the London office in 1951.

Appointed General Manager in 1947, Mr Herridge went on to become an Executive Director on the main board in 1953, Managing Director in 1957 and Deputy Chairman in 1963. He was elected Chairman in 1965, a position he held until his retirement five years later.

Mr Herridge was appointed a Companion of the Order of St Michael and St George in 1962.

He served as President of the Institute of Petroleum from 1964 to 1966. Subsequently he was appointed Chairman of the Industrial Training Board of the Petroleum Industry.

ENI and Agip merge operations

ENI is streamlining its business through a merger with Agip, of which ENI is the sole shareholder. The merger with Agip, the oil and gas exploration and production company, will not result in any modification of its corporate objectives in the upstream sector but will 'increase efficiency and effectiveness in decison making' while speeding up the exchange of information and reducing operational costs.

The merger is to be put to shareholders at an extraordinary shareholders' meeting scheduled for next month. The move will not have any effect on the share capital of ENI.

Following the merger, ENI will directly control all the main operating subsidiaries, excluding Saipem, its oil services business.

Newsdesk

17th UK offshore licensing round

The UK government awarded a total of 25 licences to 14 operators in the 17th offshore licensing round. The majority of the tranches awarded. covering 76 blocks, are west of the Hebrides; a further seven tranches, covering 28 blocks, are north of Shetland and four others, covering 10 blocks in the southern North Sea.

The successful operators are Murphy Petroleum, Statoil, Amerada Hess, Arco British, British Gas, Fina, Texaco, Elf, Marathon Oil, Enterprise Oil, Phillips Petroleum, Conoco, Mobil and Shell UK.

Unsurprisingly, the Department of Trade and Industry rejected the bid from Greenpeace for all acreage on offer as it 'did not represent a valid application'. The environmental body had put forward a proposal to 'set aside' the blocks in order that they could be thoroughly investigated to produce a better understanding of the marine life and ecosystem rather than to drill them.

Shortly after submitting its application, Greenpeace made a complaint, cosigned by the Marine **Conservation Society and** the Whale and Dolphin Conservation Society, to the European **Commission's** environment directorate DG XI claiming that the UK government could not legally issue oil licences in the round as full environmental impact assessments (EIAs) have not been carried out in accordance with the EC EIA directive passed in 1985 (see Petroleum Review, April 1997)

Total sells US refining/marketing assets

Ultramar Diamond Shamrock Corporation has acquired the refining and marketing assets of Total Petroleum (North America) Ltd (TOPNA) in a deal valued at some \$811 million. The agreement provides for Ultramar to issue 0.322 of its shares for each outstanding share of TOPNA stock. The new company will have an annual refining capacity of 650,000 barrels per day, 6,381 service stations in 19 states in the United States and

six provinces in Canada, some 9,140 km of crude oil and refined products pipelines and over 23,000 employees.

Synergies resulting from the combination of the two companies are expected to lead to savings in the region of at least \$50 million per year.

Total's service stations in Texas, Colorado and Oklahoma are to be rebranded as Diamond Shamrock. All other outlets will maintain the Total name.

Statoil/Sasol gas conversion alliance

Statoil and Sasol Limited of South Africa have formed an alliance to develop a floating concept for the conversion of natural gas to synthetic crude oil and liquid fuels utilising Fischer-Tropsch technology.

The companies report that they are already well underway with developing a conversion plant that could be placed on ships or other floating oil and gas production systems. Such a facility would allow natural gas to be utilised at the point of production rather than

being piped ashore or reinjected into the reservoir a procedure that would eliminate the need for flaring of natural gas and its associated environmental problems. state the companies.

Statoil and Sasol intend to make the floating gas conversion facilities available on a commercial basis to other oil and gas producers. It is also thought that the new technology could provide a market for Statoil's large gas reserves in northern Europe.

New direction for British Energy

UK nuclear power operator British Energy has made its first move into gas-fired electricity generation with the acquisition of a 12.5 percent stake in Humber Power Ltd (HPL), owner of the 1,260 MW combined cycle gas-fired power plant development at Stallingborough. North Lincolnshire, for some £20 million.

Elf Aquitaine, through its subsidiary Elf Exploration UK. has also acquired a 12.5 percent interest in the company. The

company has already played a major role as a gas supplier for the first 750 MW phase of the project which is due to be commissioned shortly.

It is also contracted to supply gas to the second phase (510 MW) which is due to be commissioned in 1999.

HPL is a joint venture company owned by subsidiaries of Imatran Voima OY, the Finnish electricity utility, Midlands Electricity, Japanese trading company Tomen Corporation and ABB.

New problems for Shell in Nigeria

Shell Petroleum Development Company of Nigeria Limited (SPDC) was forced to shut down oil production at six production stations in Delta State on 23 March after protestors angry at recent political changes to local government occupied the facilities and held workers hostage. The dispute was not related to earlier disputes over Shell's oil exploration activities in the country.

Some 100,000 barrels a day (b/d) of production was shut in at the Egwa-1, Egwa-11,

Odidi-1, Odidi-11, Batan and Jones Creek facilities. SPDC's Western Division normally produces about 450,000 b/d.

While Shell managed to maintain deliveries during the dispute by drawing on stocks, force majeure was declared on a number of oil shipments from the Bonny terminal as reserves became almost exhausted. However, shipments were resumed after just three days.

Deliveries from the Forcados terminal were unaffected.

Beacon Gas cuts domestic gas price

Beacon Gas, the Seeboard and Amoco joint venture, is further reducing prices for its UK domestic gas customers from this month by up to £12.50 a year. As part of the cuts, the discount that customers receive for paying by direct debit will double to £8 per year. Similarly, prepayment customers will receive an annual discount. Beacon

According to Managing Director Alan Lias, the new price is being introduced as a direct result of the company's success in attracting new customers - over 50,000 signed up in Sussex and Kent within the first month of the new free market opening.

An average gas user will now be able to save 18.7 percent against the British Gas standard credit tariff, states the company.

Release of Australian exploration areas

Thirty-four vacant areas offshore Australia have been released for work programme bidding in 1997.

The majority of the offering, some 27 areas, are centred in the Browse and Bonaparte Basins on the North West Shelf off the coast of Western Australia.

The remaining seven areas are located in frontier to mature exploration settings in the Duntroon, Sydney and Gippsland Basins offshore South Australia, New South Wales and Victoria, respectively.

Most applications must be lodged by 27 November. However, those for some areas on the North West Shelf do not have to be submitted until 26 March 1998.

Diary Dates



Exploration and Production Discussion Group

'Technology and Teamwork – The West of Shetland Challenge'

Thursday 15 May, tea at 17.00 for 17.30 until 19.00

By David Llewelyn, Operations Manager, Schiehallion, BP Exploration

IP contact: Jenny Sandrock

THE INSTITUTE OF PETROLEUM

PG

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Energy Economics Group

'The In Salah Gas Project: BP's partnership with Sonatrach in Algeria'

Thursday 22 May, 17.00 for 17.30 until 19.00

By Mike Heffner, Business Unit Manager–Algeria, Southern Europe Gas, BP Exploration

IP contact: Jenny Sandrock

West of Scotland Branch

'Environmental Stewardship in Shell Expro: Matching Words with Action'

Tuesday 20 May, 18.00 At the University of Strathclyde

By Heinz Rothermund, Managing Director, Shell UK Ltd

Applications for free tickets should be made to W H Beaton, 63 Carlton Place, Glasgow G5 THE INSTITUTE

London Branch

'Back to Basics – Liquefied Petroleum Gas'

Wednesday 21 May 17.15 for 18.00

By David Hepworth, Conoco Ltd

LPG fulfils an important role in the gaseous fuel sector despite the growth of natural gas. Because it is stored in the liquid phase it offers significant advantages for many specialist applications, from industry to the garden barbecue. David Hepworth will explain the sourcing, supply and marketing of LPG. He will also consider potential new areas of development that will strengthen its competitiveness and ensure a long-term future. The meeting will be preceded at 17.30 by the Branch AGM and will be followed by light refreshments.

Enquiries: Mrs E Walker, Hon Secretary, London Branch, Tel: 01926 404768 or Mr J M Wood at the Institute, Tel: 0171 467 7128

'Annual Visit – The Royal Mail Sorting Office, Mount Pleasant'

Wednesday 18 June

The Annual Visit of the Branch will be to the Royal Mail's Mount Pleasant Sorting Office in Clerkenwell. There will be a guided tour of the office, one of the largest in the world, commencing at 18.00. Numbers will be restricted to 20 visitors. Those wishing to attend should notify Mr J M Wood at the Institute in writing or by fax not later than 30 May

IP Contact: J M Wood, Fax: 0171 255 1472

All meetings are held at the Institute of Petroleum unless otherwise stated. Please tell the IP contact if you plan to attend any of these free meetings Tel: 0171 467 7100 Fax: 0171 255 1472

Migration or replenishment in the Gulf

By Judith Gurney

n 1972, one of the world's most prolific Pleistocene oil and gas fields was discovered 6,000 feet below the seabed in 700 feet of water in the Gulf of Mexico off the coast of Louisiana. By 1997, this Eugene Island Block 330 field, operated by Pennzoil, had yielded more than 1 billion barrels of oil and was still pumping it out.

Remarkably, its estimated reserves have declined much less than the amount predicted on the basis of its production rate. It would appear that its reservoirs are being replenished by an input of oil and gas, probably coming from very deep source rocks. If so, it may be that El 330 should be considered a steadystate, renewable resource, rather than a finite one. The larger question, then, is whether other hydrocarbon fields in the Gulf, and elsewhere, could also be renewable resources.

Petroleum seeps

Petroleum escapes from deep onshore and offshore source beds as a result of pressure arising from compaction or, in some cases, gas generation. It ascends towards the surface through thick layers of sediments, probably through faults and fractures or possibly through other types of viable pathways in fine-grained sediments. Eventually, it either comes to rest in a reservoir trap which prevents further movement, or reaches the surface as seepage. Onshore and offshore seepage is visible proof of the past, or present, leakage of oil, gas or bitumens from the subsurface. It often indicates the presence of nearby subsurface reservoirs and many of the world's important oil producing regions were first discovered through the evidence of seepage.

Seeps, manifested as mud volcanoes, pockmarks and craters are relatively common on the Gulf of Mexico seabed and several have diameters measuring several thousand feet. Some are the result of petroleum vertical migration directly from source rocks, presumably through salt-related faults that bypass reservoir traps to reach the seabed. Others represent leaks from reservoir traps due to imperfections in their seals. Gas bubbles emerging from the seabed and oil slicks in the water are evidence of ongoing seepage.

Gulf of Mexico seeps often have carbonate rock outcrops which are encrusted with deep-sea organisms such as crinoids and, in deep waters, such seeps may contain modules of gas hydrates. A number of seeps have tube worms and other organisms that oxidise hydrogen sulfide; colonies of clustered tube worms longer than one metre can be seen in several Gulf seeps. Seep mussels with bacterial symbionts that utilise methane are also common.

Eugene Island Block 330

The El 330 field, which covers roughly nine by four miles, is rather simple structurally, with a large growth fault system, termed the Red Fault zone, sliding down to the south as alternating sequences of sand and shale are forced into deep water from the Mississippi Delta. The field provides a unique opportunity for the study of reservoir replenishment because of its long production history. Output began in 1972 and it is one of the most extensively sampled oil and gas fields in the world. It appears to be saturated with hydrocarbons, with crude oil oozing from seafloor seeps above and to the south of it, and jets of methane shooting into the water near these seeps.

The fact that EI 330 reserves have declined less than expected, even with increased production, suggesting that its reservoirs are being replenished by upwards migrating oil and gas, has raised questions regarding the origins of the migrating hydrocarbons as well as to the cause, rate and duration of this migration. The US Department of Energy underwrote a \$200 million research effort into these questions which included an analysis of EI 330 oil samples taken over a 16-year span from the same well and at the same depth.

Oils and gases which have similar definable characteristics based on their geochemical properties such as biological markers, sulfur compounds and carbon isotopes, can be assumed to have been generated from the same source, although not necessarily at the same time. The tests of El 330 oil samples showed that the wide range of the oils in the different reservoirs of the EI 330 field had very similar maturities showing their evolution from kerogen, the substance formed from sedimentary microfossils, and a very homogeneous biomarker composition. They were definitely related to one another and to a deeper source rock of Early Cretaceous or Jurassic age.

The analysis also indicated that oil and gas injections into some reservoirs may have occurred in recent years. The geochemical evidence coupled with temperature, pressure, overproduction and seismic amplitude anomalies in the field suggested that some of the oil being produced in the mid-1990s was not present in the field at the beginning of production in 1973. Oils produced in 1984 from the same perforation depths in the same wells were less heavily biodegraded than either the oils produced in 1973 or those produced in 1988. In addition, light gasoline ratios in the 1973-produced oils were generally larger than those in the 1988-produced oils. Degradative chemical changes in





oils resulting from action by oil-eating bacteria suggested that oil was moving in quite rapid spurts from great depths to reservoirs near the surface.

Dynamic petroleum migration theory

Several organic geochemists have proposed a scenario to explain El 330 replenishment. This scenario postulates that EI oils were first generated in the early Tertiary period from Jurassic rocks containing decayed organic matter of both plant and animal origin deeply buried in sediment under conditions of high temperatures and pressure. The oil created at this time initially would have been a liquid until additional layers of sediment and salt buried this source bed to greater depths. Later, under the resulting highly pressurised, superheated conditions, the oil was cooked and cracked to methane. Methane, however, could not exist in its gaseous form at such pressures and temperatures and became something which is neither oil nor gas but a substance in between called a supercritical fluid, in which large amounts of oil can be dissolved.

In time, according to this scenario, ongoing cracking of oil to methane produced sufficient gas pressure to drive an upward flow of the supercritical fluid and open the fracture system, as shown in the diagram. Its ascent may have been stopped by a dense sedimentary layer but renewed pressure build-up would have caused a crack to form in the barrier and the highly pressurised mixture to burp upward again. At higher levels where temperatures and pressures are lower, the methane would not be able to remain in its supercritical state and the mixture of gas and oil would separate out into its respective components. These could continue to rise towards the surface through existing faults to producing reservoir traps.

At sites where there is a lot of faulting

in the sedimentary layers, the upward movement of oil and gas from source beds could be an ongoing process if active gas generation from oil cracking is occurring continuously at depth. According to organic geochemists Jean Whelan and David Darby at the Woods Hole Oceanographic Institution in Massachusetts, this may be the case in the EI 330 field. They believe that the field's reserves may be undergoing replenishment with oil and gas travelling upward from one or more deeper reservoirs to one or more shallower reservoirs connected by a fault system. Large volumes of oil and gas can be released rapidly in transient bursts up a fault zone to a reservoir trap with a relatively impermeable seal. Although the release of the hydrocarbons drops the pressure, the cycle can be repeated over and over again when pressure builds up again due to continuous gas generation. A variety of preliminary geophysical, geochemical and geological observations along with well production

Migration scenario



data have led to the hypothesis that fluid injection into El 330 reservoirs may be a continuous episodic process.

Migration routes

The phenomenon of EI 330 raises many questions regarding the cause, rate and duration of the migration of oil and gas from greater depths. Migration direction and distances from source kitchens to reservoirs which can be commercially produced depends, to a large extent, on basin size and configuration and distances can vary considerably. Locating migration routes could prove important to the oil and gas industry as it would help locate reserves either along the pathways to known large accumulations or on spill routes between one large accumulation and another. In addition, it might be possible to drill wells into active migration pathways and produce these streams directly to the surface as was attempted in the El 330 Pathfinder drilling project.

Although scientists have made great strides in finding methods to identify the source characteristics of petroleum systems, they still face difficulties in finding ways to determine the routes, distances, time and frequency of oil and gas migra-

tion from source beds to reservoirs. Data from structural maps, sediment distribution and basin modelling suggest possible migration pathways and scenarios but these do not provide evidence for the most likely migration route. Scientists at the Newcastle Research Group at the University of Newcastle are involved in research into ascertaining ways to determine migration pathways and distances. As noted in a February 1997 Petroleum Review article, Steve Larter and colleagues have found that non-alkylated benzocarbazoles, nitrogen-containing isomers which are present in trace quantities in oils, exhibit changes in concentration which correlate with migration distances.

Pathfinder well

In some cases, as in El 330, at least some of the route is evident and can be investigated directly. In late 1993, Pennzoil drilled a well in an El 330 reservoir located just above the so-called Red Growth Fault Zone that forms the northern boundary of this mini-basin. It then extended the well through the fault zone and into the Red Growth Fault. The US Department of Energy sponsored this extension and an analysis of fault conditions by the Global Basins Research Network (GBRN), a consortium of university and industry scientists formed to model fluid flow in sedimentary basins. GBRN conducted core sampling, logging, imaging and stress testing within the fault. These revealed oil and gas from silty shales within the fault zone with geochemistry similar to the oil and gas being produced from reservoirs directly above the fault zone. They also found that the hydrocarbons in the fault did not flow at economically viable rates during drill-stem tests, with flow decreasing as pressure decreased. Bottom-hole tests, however, showed that a small increase in pressure from below, such as from upward migration of gas, would have caused the flow to begin again.

Other refilling reservoirs?

The phenomena of El 330 replenishment may not be unique. Other oil and gas fields, particularly those in river deltas, may also be continuously, or intermittently, refilling with hydrocarbons from

Biological markers

Biological markers are organic compounds which are sufficiently stable to be recognised in crude oil. Their carbon structures, or skeletons, are formed from kerogen which, in turn, is formed from sediment microfossils. These markers are highly variable in their stereochemistry or spatial arrangement of atoms and groups in their molecules. Because of this variability, fossil biomarkers frequently can be linked directly to the specific groups of plants, animals or bacteria from which they originated. Typical markers are the porphyrins, pristanes, phytanes, steranes, carotanes and pentacyclic triterpanes.

deep within the earth. This could make these fields, in a sense, renewable resources on either long, or short, timescales. Seeps and evidence suggestive of dynamic petroleum migration into nearsurface reservoirs exists in the Niger River Delta, the Trinidad Basin, Indonesia's Mahakam River Delta and the North Sea. A number of oil companies are aware of the possibility of replenishing reservoirs in these areas but question whether the process occurs rapidly enough to make any impact on commercial production. There is virtually no data on how fast oil comes into reservoirs.

Certain geological conditions are necessary for dynamic petroleum migration to occur. These include active source kitchens continuing to generate gas, faults or fractures, overpressure and the of existence reservoir traps. Overpressure is commonly found in rapidly subsiding river deltas where fine-grained mud gets washed further ashore as the result, in the case of the Gulf of Mexico, of sediments dumped in the basin by the Mississippi River. This sedimentary filling results in thick layers of dense delta mudstones which serve as a seal preventing the upward flow of fluids or gases. Overpressure can also be associated with large sub-salt formations. Many wells drilled in Gulf of

Mexico sub-salt exploration have revealed sediments under salt formations which were extremely overpressured.

Although the principal cause of overpressure in sedimentary basins is generally considered to be compaction, there is evidence that gas generation can also be a cause of overpressuring. Overpressure is not limited to river deltas. The Jurassic structure of the Central Graben in the North Sea, for instance, is characterised by highly overpressured subsidence as a result of tectonic forces generated from stretching following the opening of the Atlantic in the remote geologic past.

The presence of deep and shallow reservoirs is considered a prerequisite for the occurrence of dynamic petroleum migration. Petroleum which escapes from a source kitchen will rise until it is trapped in a deep reservoir. When pressure sufficiently builds up in this reservoir to create a fracture in its seal, the upward migration process will repeat, filling shallower reservoirs. (Since oil and gas may migrate long distances horizontally under an impermeable seal, the reservoir layers may not be in an exact vertical position above the source kitchen.) Eventually, episodic flow reaches a reservoir which is under production or which can be produced economically. If the source rock filling the deep reservoir is still generating hydrocarbons, the cycle can be continuous, so that a revisit to an old field pumped dry might find it productive again.

Implications of the theory

While many geochemists agree that refilling of commercially producible reservoirs is possible and is occurring at El 330, they disagree about the mechanism, the timing and the speed of replenishment. Some argue that the process is not continuous and also that it occurs only at a very slow rate. Extensive research is needed into the possibility of dynamic petroleum migration at onshore and offshore sites worldwide. An intriguing consequence could be the postponement of the abandonment of production structures in offshore fields until the existence of dynamic petroleum migration is proved, or disproved.

IP Mission Statement, Objectives and Strategies

MISSION

To be the best independent European centre for the advancement and dissemination of technical, economic and professional knowledge relating to the international oil and gas industry.

or 60 years the Institute of Petroleum has been one of the principal independent bodies in Europe concerned with the advancement of technical and economic knowledge in the oil and gas industry around the world. That role remains essential as the industry faces the increasing influence of Europe, recognises the growing importance of safety, health and environmental issues and seeks to improve performance against a background of technological, political and legislative changes. The Institute offers expert, impartial guidance as well as an opportunity to participate in vital discussions and developments, while its diverse and enthusiastic membership ensures that the IP's independence and focus are maintained. The Mission, Objectives and Strategies of the Institute are continually reviewed to ensure that the Institute provides a focus for ideas and activities which serve the common good of the industry. The first Mission, Objectives and Strategies were developed in 1992. The IP Council has recently reviewed and modified them to incorporate the changes shown here.

Objectives

The specific elements of success that must be achieved in order to fulfil the 'Mission' are:

 Independence – to preserve an industry focus independent of government and commercial interest

 Membership – to increase the IP membership, maintaining diversity and expanding international representation

 Lifetime learning – to assist members to acquire the professional knowledge, values, skills and understanding they require throughout their lifetimes

 Research – to manage research programmes in those areas of common interest to members Technical – to secure the international recognition of IP Codes and Standards

 Forum – to provide a focal point for interaction between all interested in the oil and gas industry.

Strategies

The broad courses of action to meet the objectives are:

Financial

The Institute will enhance its financial independence by funding new and expanding activities through increased individual and collective membership and other internally generated revenue.

Membership focus and service

Centrally and through the IP branches, the Institute will identify and be responsive to the needs of all categories of its current and potential membership. It will develop an enlarged and improved range of services of perceived value to members, thus increasing the financial contribution to the Institute.

External relations

The Institute will develop and strengthen its relations with governmental agencies and relevant professional bodies and trade associations particularly in the United Kingdom, Continental Europe and the United States of America. It will actively promote the Institute's distinctive position on issues where it is in the interests of members to do so.

Research

The Institute will promote a focused programme of objective research by maintaining a dialogue with the membership, government and regulatory authorities to identify projects of mutual benefit and by demonstrating its competence to manage and publicise the results of such research.

Lifetime learning

The Institute will implement integrated plans to cover services offering opportunities for members' learning, information and networking.

Reputation

The Institute will foster its reputation internationally by active and consistent use of the IP name. This will be achieved through continuing quality improvement of IP products and services.

Communications

The Institute will ensure that its aims and achievements and the range of services which it provides such as organising technical meetings, conferences, workshops and the publication of technical and nontechnical material, are recognised by existing and potential members, by government and other bodies with which it seeks to co-operate and influence, by industry and the general public.

International

The Institute will extend its influence internationally, and particularly in Europe by promoting technical co-operation, expansion of its membership and development of its contacts with EU and national agencies. It will also further develop its long-established relationship with other international technical and standardization bodies, particularly API and ASTM. In addition it will provide appropriate UK technical representation on international standardization committees and workshops.

Education liaison

The Institute will increase the knowledge and understanding of the oil industry by young people so that they see it as providing stimulating and fulfilling opportunities.

Human resources

The Institute will recruit and retain high quality staff by offering challenging opportunities on an equal opportunity basis.

A competitive reward structure will be maintained which recognises individual contribution. Close liaison will be maintained with members to ensure that all committees and working groups are staffed by people with high quality and relevant experience.

Information technology

The Institute will increase the use of integrated systems and databases, and appropriate technology, to improve the effectiveness and reduce the costs of administration and the provision of enhanced services to members.

lan Ward, Director General

Letter to the Editor

Madam,

Modern Asset Pricing

Capital budgeting is an important topic and coverage of it in your journal is welcome.

The majority of capital budgeting decisions are made under risk, being circumstances where it is reasonable to assign probabilities to possible outcomes. Some decisions, however, have to be made under uncertainty, being circumstances where a catastrophic (ie step) change in the external environment, such as possible re-entry into the market of a major supplier such as Iraq in the case of upstream oil investment, or the emergence of serious sideeffects late in clinical trials in the case of pharmaceutical R&D, cannot be ruled out but cannot, at the same time, be assigned probabilities with any confidence.

Applied correctly, risk-adjusted DCF (discounted cash flow analysis) still provides the best means of analysing projections for investments to be made under risk. Proper application involves the appreciation that discount rates should be separately evaluated for each accounting period and that the inputs required to estimate both financial and operating leverage in developing the parameter B in the CAPM (capital asset pricing model) are readily available in the capital budgeting situation. It also critically involves the appreciation that B reflects operating volatility in the industry in question and not the difficulties of forecasting cash flows, which have to be dealt with separately before discounting.

The problem that arises in capital budgeting under uncertainty is that confidence in the forecasts is weak precisely because the Bayesian (probabilistic) methods which can readily be applied under risk are no longer appropriate. Game theory provides ways of limiting exposure to uncertainty, such as the analysis of expected utility, but these still require estimates of payoff which in themselves represent DCF net present values. They also make no allowance for the possibility of modifying the risk and, in particular, of deferring commitment pending better information on the uncertainties.

Deferral of commitment while retaining the ability to invest at a later date represents a call option. Neither DCF nor game theory offers any direct means of estimating the value of such options but the seminal work of Black and Scholes on the valuation of financial options is now recognised as being applicable to capital budgeting and many are exploring its possibilities.

The work of Professor Laughton reported on by Peter Adam in your February issue (p82-83) may well yield useful insights when it has been extended from the special case of copper mining in which it originated and when it has been through the disciplines of formal publication. Meanwhile, with too many capital budgeting decisions still being made without the benefit of properly applied risk-adjusted DCF, it is unfortunate that Prof Laughton's ideas should be promoted with such a farrago of inaccurate comment on the alleged shortcomings of DCF and the CAPM. Specifically:

 DCF can equally be decomposed to treat different elements of cash flow separately, where that is appropriate.

- Techniques such as Monte Carlo simulation (which is a probabilistic technique) and Black Scholes address the forecasting problem and neither eliminates the need for subsequent DCF analysis nor invalidates it.
- Financial and operating leverage can and should be factored into the estimation of project β for riskadjusted DCF analysis (the fact that they are often not is a failing of the analyst, not of the method) and simple algorithms for that purpose are readily available.
- DCF analysis only undervalues distant cash flows if, incorrectly, a constant rate of discount is applied over all projected accounting periods.
- The development of risk measures in the course of analysis as represented by Mr Adam would, of course, involve circular argument and be invalid. Study of materials provided by Prof Laughton indicates that his method in fact develops risk measures from external sources (copper futures in the case of the work so far reported) but this procedure involves at least as much subjectivity as the assessment of ß for the CAPM.

It is a pity that Prof Laughton should allow his work to be demeaned by such overstatement and by Mr Adam's intemperate comments. Such an approach has no place in any serious discussion of a most important issue nor, indeed, in any serious journal.

David Neil, M Inst Pet Managing Director, DJ Neil Ltd

Peter Adam's reply:

I am flattered, though somewhat perplexed, that Mr Neil, despite the 'glaring technical errors' he claims to have noted, saw fit to read my entire 'polemic' on modern asset pricing, even the final paragraphs, which were the only part of the article that in my view could be construed as 'sensationalism.'

Mr Neil and I seem to agree that the DCF/IRR approach used by many is

highly flawed. I reiterate my contention that the modern asset pricing model as developed by Prof Laughton and his associates is far superior. I also stand by everything I wrote about DCF/IRR, project finance, the capital asset pricing model, CAPM, the highly flawed corporate culture of many major and minor oil companies and the limitations of the way many companies allocate capital. Prof Laughton and his colleagues reviewed my article before publication and their suggestions were incorporated. I, however, take full responsibility for everything I wrote and look forward to learning more about Mr Neil's explanation of what DCF/IRR can and cannot do. If he has come up with a better mousetrap, I myself, my clients and my colleagues in the international petroleum industry would certainly like to know about it.

Keen foreign interest in Pakistan

By Deepak Mehta

espite a reputation for Despite a reputer instability, Pakistan continues to attract keen attention from the world's major oil and gas companies. Interest is not just confined to the potentially profitable upstream exploration and prospecting industry but also to downstream refining and distribution, where significant multi-million dollar projects are planned to meet the country's insatiable demand for petroleum products.

Pakistan has many attractions for foreign oil and gas companies. First among them is a projected energy shortfall of 20 percent by the year 2000, although the country has proven gas reserves of 31 trillion cubic feet (tcf) and proven crude oil reserves of 491 million barrels. A recent report by the UK government's Oil, Gas and Petrochemicals Supplies Office (OSO) says the figures could be as high as 200 tcf of gas reserves and 33 billion barrels of crude oil reserves. The report says the oil and gas discovery rate in Pakistan is proportionately higher than most countries, with a strike rate of one in four compared with an international rate of one in 10. It adds that of 378 exploratory wells in Pakistan, 44 have led to significant oil finds and 57 to major gas discoveries.

Enlightened policy

The last four years have seen Pakistan accelerate its efforts to deregulate the market and encourage outside investment in its oil and gas sector. The 1994 petroleum policy is generally regarded as one of the most enlightened in Asia.

The policy divides Pakistan into three zones, providing higher prices for production from riskier zones, such as Baluchistan in the lawless North West Frontier Province (NWFP). It also allows for the duty-free import of exploration and production equipment, while guaranteeing a 25 percent return for pipelines and refinery projects that use domestic supplies. The government has a 5 percent stake in all concessions at the exploration stage, and its Post Commercial Discovery share is 15 percent from Zone 1 (high risk); 20 percent from Zone 2 (medium risk); and 25 percent from Zone 3 (low risk). The Ministry of Petroleum is currently lobbying the government to introduce a fourth zone to include offshore areas where foreign companies are unwilling to invest, maintaining that the risks outweigh the potential benefits.

Pakistan's oil reserves are mainly located in two regions: the Potwar plateau, southwest of the capital Islamabad; and the Lower Sindh Province. Natural gas is primarily produced in the Sui and Mari fields.

Generous government incentives have led to a host of companies entering a market which until recently was dominated by just five players: Pakistan Oil Fields, Oil and Gas Development Corporation, Union Texas Pakistan, Occidental of Pakistan and Pakistan Petroleum Ltd. Although Union Texas accounts for 30 percent of Pakistan's oil production and 10 percent of its gas production, it now faces intense competition from elsewhere. The OSO report confidently predicts there will be a total takeup of the concession licences on offer.

Escalating demand

Pakistan is a market where demand for oil products and natural gas far outstrip supply. A very small proportion of the population has access to piped gas supplies, while the waiting list of those wanting gas runs into millions. Last year, imports of crude oil and refined products cost Pakistan \$1.7 billion and there is widespread recognition that this figure will rise to almost \$3 billion in the next three years, particularly with the introduction of new oil-fired power plants. Indigenous oil production satisfies just 41 percent of current demand.

Companies active in Pakistan include Shell, LASMO, Hardy Oil and Gas, British Gas and Premier Oil. All have targeted Pakistan as a market with huge potential and were represented at a highprofile oil and gas seminar held in the Pakistani port city of Karachi in March, called to coincide with a visit by the royal yacht Britannia.

LASMO has a well-established presence in Pakistan, dating back 10 years. Two years ago the company's \$200 million investment at its Kadanwari gas site, 330 km northeast of Karachi, began to pay off with a major discovery of gas. Kadanwari is expected to produce 100 million cubic feet (mncuft) of gas per day and holds a staggering 700 billion cubic feet (bncuft) of gas reserves.

LASMO is also prospecting in Western Sindh Province (Kirthar Concession) where it has an equal partnership with Shell (47.5 percent) and the government of Pakistan (5 percent). The company is actively lobbying for three new prospecting concessions to the west of Karachi: Kirthar West, Bela North and Bela South. LASMO Chief Executive Joe Darby accompanied British Prime Minister John Major on his recent trip to Pakistan to press the company's case.

Despite the success of companies like LASMO, Pakistan's dependence on foreign imports of gas and petroleum products is likely to last well into the next century. Recognising this, the government has earmarked a staggering \$23 billion for oil and gas development projects over the next five years.

Much of the money will come in the form of loans from the World Bank and the Asian Development Bank. Their lending conditions, however, are more stringent than in the past. Loans to Pakistan's two nationalised gas transmission companies – Sui Northern Gas Pipelines Ltd and Sui Southern Gas Company Ltd – are accompanied by stringent privatisation clauses. The government has agreed that 26 percent of the two companies' equity will be sold to the private sector.

Successive governments in Pakistan have realised the need to put aside political differences in favour of a common policy for the oil and gas sector – recognised as critical to the country's future. The local appetite for refined petroleum products is growing at an average 15 percent per annum, while indigenous production of refined products accounts for just 40 percent. To counter this a vast array of oil and gas projects designed to ensure petroleum and gas supplies beyond the year 2000 have been given the go-ahead.

Pipeline projects

Among the most ambitious is a project to ship natural gas supplies via pipeline from the former Soviet republic of Turkmenistan through Afghanistan into northern Pakistan. Political turmoil in Afghanistan, however, makes it unlikely the pipeline will yet be constructed, despite the signing of a memorandum of understanding between the governments of Turkmenistan and Pakistan. Two further overland pipeline projects are under active consideration. The first from Iran, the second from Qatar. Shell Pakistan is leading a consortium of companies to build a 900-km white oil products pipeline from Karachi to Multan at a cost of \$600 million. Other projects include a plan between LASMO, National Power and the government of Pakistan to import liquefied natural gas into Karachi from Indonesia.

Refining plans

Money has also been allocated to upgrade Pakistan's refining sector. There are three refineries (two in Karachi and one in Rawalpindi) with a combined capacity of 6.3 million tonnes per annum – well below the 14 million tonnes of present requirements. Plans for a further two refineries with a combined capacity of 10.5 million tonnes are at an advanced stage. Work on the \$800 million Pak-Arab (PARCO) refinery in Multan is expected to begin later this year under the supervision of UK consultants Babcock King Wilkinson. A joint venture between South Korea's Hyundai Engineering and the government of Pakistan to build a refinery on the Hub river is also at an advanced stage.

Two major challenges face any foreign company entering Pakistan. The first involves serious distribution bottlenecks in the downstream sector. The OSO singles out poor infrastructure and congested ports and railways which affect distribution as major obstacles to growth in the petrochemicals industry. It also notes that, although Pakistan has a modern distribution system for natural gas, it is overloaded and in need of upgrading.

The biggest challenge, however, may prove to be cultural. The OSO report concludes: 'Pakistan is ruled by an elitist faction of Sindhi and Punjabi feudal landlords, the families of whom fill the national and provincial assemblies and the upper echelons of the bureaucracy and the army. It has been estimated that just 500 families rule Pakistan. Public life has therefore been manipulated by wealthy families and this has encouraged corruption and patronage with the law often being turned into a tool of political manipulation.'



Gas pipeline projects

Yemeni LNG on the right track

n January seven agreements establishing the Yemen Liquefied Natural Gas Company (YLNG) were signed at an official ceremony in the Yemeni capital Sana'a, marking the culmination of more than five years of tough negotiations between the different parties to form a viable venture for the export of LNG. This represents the fifth scheme for natural gas liquefaction in the Middle East after Abu Dhabi's Adgas, Qatargas, Ras Laffan - both of Oatar - and Oman LNG.

The LNG project calls for the development of natural gas reserves in the Marib area in the northern part of the country. Natural gas will be pumped through a 320-km, 34-inch pipeline with a capacity of 830 million cubic feet/day (cuft/d) to a liquefaction plant at the coastal town of Bal Haf on the Gulf of Aden, about 100 km west of the city of Mukalla. Bal Haf was selected for its topography and strategic location (open seas), as well as for economic considerations - it is shorter and cheaper to lay a pipeline from Marib to the Gulf of Aden than through a difficult route to the Red Sea coast.

The liquefaction plant will have a baseload capacity of 5.3 million tonnes/year over a 25-year period, with two trains of 2.65 million tonnes/year operating with APCI process, and two (70- and 30-MW) main power drivers per train. There is a provision in the accords

By Dr Naji Abi-Aad

for a third train, the terms of which would have to be negotiated separately. The facilities will also include two storage tanks with a capacity of 120,000 cubic metres (cum) each and one single berth capable of accommodating LNG carriers of up to 140,000 cum and loading them at a maximum rate of 12,000 cum/hour. The project is estimated to cost around \$3 billion. Financing will be undertaken on both recourse and nonrecourse bases, with 60 percent provided from external borrowing, and the rest from the equity partners of the YLNG.

The YLNG is a joint venture between the state-owned Yemen Gas Company (YGC, 26 percent), Total (36 percent), Hunt Oil (15.1 percent), Exxon (14.5 percent) and Yukong (8.4 percent). It will own and operate the LNG facilities. Negotiations are currently under way to sell 11 of the YGC's 26 percent share to South Korea's Hyundai and/or Japan's Shoseki Overseas Oil Development Company (Sodec), a subsidiary of Showa Shell Sehivu. Botas, the oil and gas pipeline subsidiary of the state-owned Turkish Petroleum Company, has also expressed interest in acquiring shares of up to 10 percent in the project to be deducted from the foreign partners' equity holdings.

The LNG project involves three phases, the first of which (front-end engineering and design (FEED), contracting, financing and marketing) is being carried out under the management of Total and is expected to be completed by the end of this year. So far, the certification of gas reserves, a survey of the pipeline route, the preparation of the downstream site and the drafting of FEED bid documents have all been undertaken. Phase II, the project implementation stage, is scheduled to be completed in the year 2001 when the Phase III start-up is expected to be achieved.

Under the agreements, the Yemeni government will ensure the availability of natural gas reserves sufficient for the whole LNG output over 25 years, while it is the responsibility of the Yemen Exploration and Production Company (YEPC) to deliver the feed gas from its Marib fields that currently yield about 160,000 barrels per day (b/d) of crude oil and 2.2 billion cuft/d of associated gas. Hunt Oil is the operator of the YEPC, partnered with Exxon and Yukong. Proven and recoverable gas reserves of fields already discovered in the Marib area are estimated at about 11 trillion cubic feet (tcf), while the volumes of sales gas available to the project amount to around 9.5 tcf including 1 tcf to be allocated for domestic use. In case the two LNG trains produce more than their designed output capacity, it will be necessary to explore for additional gas. In fact, under the agreements YLNG can offer incentives to the holders of the Marib concession to explore for more gas, if required.

The Yemeni government will receive revenue from royalty and profit share resulting from the sales of LNG, as well as a 60 percent share of the upstream fees. On the basis of an average price of \$18-20 per barrel of Brent crude and on a floor price of \$2 per million Btu escalating on the basis of US inflation rate, the government estimates its net annual real revenue from the gas exports at \$500-600 million.

One major concern for the Yemeni authorities and the YLNG is to reach final agreements with potential LNG buyers. In December 1996, a memorandum of understanding was signed between the YLNG and Botas for the supply to Turkey of 2.6 million tonnes/year of LNG over a 25-year period. The YLNG is planning a marketing campaign in Asia and the Far East to attract other buyers.

In another development, the partners of YLNG agreed to build a 210-km, 14-inch, 100-mncuft/d natural gas spur line from Marib to Sana'a to meet domestic gas needs. The Yemeni authorities are planning to extend the pipeline to the coastal town of Hodeida on the Red Sea which will fuel industrial plants and gas-fired power stations as part of a large development programme in the power sector aiming to connect 75 percent of the Yemeni population to the electricity supply network.



Containment is too risky

R estrictions on the trade of Middle Eastern states could have dire consequences for the future of the world oil market. With the capacity of Iran, Iraq and Libya put out of reach by the blunt economic weapons of the

US, the \$40 barrel could be a reality by 2010. Sheikh Ahmed Zaki Yamani, Chairman of the Centre for Global Energy Studies, argues for flexibility in the search for innovative political solutions in the Middle East. 'zl would like to address a topic of great international significance but one that has not – in my opinion – received the attention it deserves. It concerns US policy towards the Middle East and its effect on the oil industry. I hope to convey my fears that the current US policy stance in the region is not conducive to the future stability of oil prices – a matter of paramount importance to the global economy.

Before I address this issue, I would like to place it in context. At the rate oil demand is growing these days and despite robust growth in non-OPEC output, it is highly likely that by the year 2005 – only eight years away – almost 10 million barrels per day (b/d) of additional oil will be needed from OPEC. On present plans, OPEC will be able to cope with this extra demand for its oil but it needs Iraq to be producing to its considerable potential by then.

Putting it differently, if the world is not able to call on 6.5 million b/d of extra Iraqi, Iranian and Libyan oil capacity - that is, capacity in the three states bearing the brunt of the US containment policy - there is bound to be strong upward pressure on oil prices. Iraq's oil potential is second only to Saudi Arabia's, so that it comes as no surprise to find that Iraq alone accounts for almost half of the additional 11.5 million b/d of capacity OPEC is expected to install by 2005. What happens to Iraq is therefore of critical importance to the stability of oil prices.

Iraq

The cornerstone of current US policy towards the Middle East is the dual containment of Iran and Iraq – countries the United States considers a threat to the region. Taking Iraq first, there is a broad international consensus that Iraq must comply with all the relevant UN resolutions – especially those pertaining to the elimination of all weapons of mass destruction – before it can be allowed to export oil freely. The Iraqi President, Saddam Hussein, for his part, is doing little to help meet the UN requirements and therefore bears a

Sheikh Ahmed Zaki Yamani

heavy responsibility for any delay in Iraqi oil's full return to the market. There is more than a suspicion, however, that – no matter what Saddam Hussein does – as long as he remains in power there is no chance whatsoever that Iraqi oil will flow freely again, if the United States has anything to do with it.

This is worrying as far as the oil market is concerned, for it is known that the Iraqi oil industry is emasculated and needs years of rehabilitation. The longer Iraq is denied access to investment funds for maintenance and capac-

"The real problem is how to satisfy demand for Iraqi oil without Saddam Hussein using the revenues for destructive purposes"

ity expansion, the greater the pressure on other oil producers to fill the output gap in the years to come – and, failing this, the greater the possibility of higher oil prices.

Let me make myself absolutely clear. I am not advocating wiping Irag's slate clean so that Saddam Hussein can once again start threatening his neighbours and the world at large. What I am calling for is a novel, imaginative approach by the international community to the Iraqi question. Limited oil sales are fine for the time being but they do not help solve the world's longer-term needs for oil. The world needs Iraq's oil and will be prepared to pay for it: the real problem is how to satisfy this demand for Iragi oil without Saddam Hussein using the revenues for destructive purposes.

Iran

Iran is obviously not as significant as Irag in terms of the geopolitics of oil. It remains, nevertheless, a populous Gulf state with abundant oil and gas resources that need to be exploited for the benefit of the country itself and the world at large. The additional 0.6 million b/d of oil capacity that Iran plans to have available by 2005 would certainly help satisfy the world's growing demand for oil. As in Iraq's case, investment is needed to bring this capacity on stream and the requisite funds are most likely to come from abroad. However, in Iran's case there are no UN sanctions to contend with so that in principle there is no reason why Iran should not fulfil its potential - except, that is, for US policy.

The main objectives of US policy are simple enough - to prevent Iran from becoming the dominant power of the region and from continuing to give support to international terrorism. Rational as these objectives may be from the US point of view, they are being achieved in a way that has created difficulties for the United States with its allies. Senator D'Amato's bill prohibits those foreign companies investing more than \$40 million in Iran from doing business in the United States as well. Companies are in effect obliged to choose between Iran and the United States, which is neither fair nor necessarily desirable from a commercial point of view. As it happens, many US oil companies are none too happy either with a policy that restricts their freedom to invest where they see fit. The international oil industry is thus prevented from bringing low-cost supplies on stream for political reasons.

Libya

Libya too has fallen foul of the United States as another country suspected of promoting international terrorism and has therefore felt the long retributive arm of US policy. Like Iraq, Libya is subject to a US-inspired UN embargo that has restricted the ability of the country to expand its oil production and thus its oil exports. Libya's proven oil reserves are 30 billion barrels, seven times those of the United Kingdom, yet Libya only produces half as much oil as the United Kingdom. Although Libya is not in the Middle East, it is a large oil exporter. Furthermore, Libyan oil is but a short tanker-trip away from southern Europe. For some time now the United States has wanted to tighten the screws on Libya further but Italy, France and Germany have been opposed to any policy that might deny them additional short-haul oil supplies in the future.

Saudi supremacy

This policy of containment has already had a big impact on the oil industry. The world's dependence on oil from just a few oil producing countries has increased beyond what might be considered reasonable. In 1995, the last year for which we have a full set of trade data, Saudi Arabian oil exports amounted to 44 percent of the Middle East's oil exports and a staggering 20 percent of all the oil traded in the world – and there is little reason to suspect that this dependence on one country has changed much since then.

More significant than this is Saudi Arabia's 60 percent share of the world's current spare oil production capacity. Its share could even exceed 65 percent, if Iran's spare capacity is less than I have assumed. At this point, let me remind you of what happened last year. The world needed more oil from OPEC, its residual supplier but this oil was not forthcoming, because Saudi Arabia with almost two-thirds of global spare capacity - decided not to increase production. As a result, oil prices rose in 1996 by around \$8 a barrel from low to high point to yield a 44 percent increase.

What is more, the situation will hardly improve in the years to come, if Iraq remains constrained for the foreseeable future and the Libyan and Iranian oil industries are prevented from expanding as intended. Indeed, as a result of the containment of the three countries, oil demand may edge very near supply capacity, causing the price of oil to exceed the \$40 barrel mark by 2010 and imposing additional costs on the consumers amounting to trillions of dollars over the period 1997-2010.

Yet, as they say, it is an ill wind indeed that turns none to good. The US policy that has caused the world's dependence on Saudi Arabia, in particular, to increase so much is not without its benefits for the US economy. A few examples will suffice to convey the flavour of what one of my close associates has termed the 'mutuality of interest' between Saudi Arabia and the United States. In 1994, it was announced that two US companies -Boeing and McDonnell-Douglas, since merged - had won an order worth \$6 billion to supply Saudia, the Kingdom of Saudi Arabia's national airline, with 60 civilian airliners. In the same year, American Telephone and Telegraph was awarded a \$4 billion contract to expand and update the telecommunications network of the Kingdom, while on the horizon there looms a fighterplane deal with the United States involving F-16s said to be worth a massive \$15 billion. This is all well and

good for the US economy in the short term but what about the world's longer-term wellbeing?

So we are faced with the prospect of the world's only superpower pursuing policies that will surely increase considerably the world's dependence on a few countries for extra oil supplies and at the same time cause the price of oil to be higher than otherwise would have been the case. May I add that it is not as if the United States is gaining in popularity from such a policy. The belligerent US stance towards Iran, Iraq and Libya - when admixed with the US reluctance to press on with the Middle East peace process out of consideration for Israeli sensitivities - is playing into the hands of extremists everywhere in the region.

Therefore, I am not at all optimistic about the US policy stance in the region. Unless the United States helps to speed up the Middle East peace process, unless the United States desists from using blunt economic weapons against these countries that provide fuel for their antiWest rhetoric, unless the United States guides the United Nations towards a novel way of dealing with Iraq that does not damage its prospects of pumping large quantities of oil in the future, in short unless the United States finds ways of defusing tensions within the region instead of adding to them, there is little hope of oil price stability and much fear of tremendous economic upheavals ahead.

I wanted to end on a happy note but sadly I can only think of Lord Curzon's words that countries have neither permanent friends nor permanent enemies – only permanent interests. All that remains for me to do is to hope that the United States pursues its interests in ways that do as little damage as possible to the stability of the two things I hold very dear to my heart – the oil industry and the Middle East.

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Western Australia takes lead as finds roll in



By Jeremy Cresswell, Press & Journal

Signs are that, over the next 20 years or so, the pace of exploration and development offshore Western Australia will steadily increase on the North West Shelf and, further to the north and east, the Timor Sea. It has to anyway, if the currently forecast decline in oil/condensate production after 1999 is to be checked, let alone reversed. In March, Shell upped its commitment to exploration offshore Australia dramatically, persuaded in part by its sizeable Cornea discovery offshore on the North West Shelf. The £85 million budget for 1997 comes on top of the company's already sizeable commitment to the twin-field Laminaria/Corallina project in the Timor Sea, which is being led by operator Woodside Petroleum, an Australian company in which Shell has a 34 percent stake (see *Petroleum Review*, January 1995).

A host of companies are also pursuing opportunities/hold operatorships, not least BHP, Apache, Wapet, Woodside and Ampolex (owned by Mobil since late last year).

Ian Fraser, head of petroleum at Western Australia's Department of Minerals and Energy, believes that the oil and gas potential offshore the giant minerals-rich state is considerable.

Moreover, the string of successes, though modest in terms of individual size, appear to lay to rest the view conveyed until recently by organisations like the International Energy Agency that Australia was over the hill, particularly as an oil province.

These observers were, of course, referring to the Bass Strait, now heavily in decline, but which still offers scope for squeezing remaining reservoirs further by using technologies developed for the North Sea. The traditional view was that crude came from the Bass Strait, while the North West Shelf was gas only. But Western Australia has recently overtaken the Bass Strait as Australia's main oil producer.

More and more reserves

Now however, thanks to more and more discoveries, the oil inventory for Western Australia is more than three times higher than 10 years ago.

Gas reserves are currently put at some 36 trillion cubic feet (tcf) – equivalent to 100 years' supply, according to Mr Fraser. The prospect is that the reserves figure will rise at least 65 percent over the next few years, as currently uneconomic pockets are reclassified as viable, in part because of advances in technology and because of growing demand for liquefied petroleum gas (LPG) and liquefied natural gas (LNG), especially by Japan.

Western Australian output is running at an all-time high, averaging around 277,000 barrels of liquids and 1.95 billion cubic feet (bncuft) of gas per day. This is modest by North Sea standards but enough to make the petroleum industry the immensely wealthy state's second largest export earner.

But, North West Shelf discoveries have, until recently, really only trickled in. The real boost did not come until January 1994 when the Chinook, Scindian and Griffin fields in the Carnarvon Basin were collectively



brought onstream by BHP as Griffin using an FPSO (see *Petroleum Review*, May 1994).

Roller and Skate followed in May 1994; the Goodwyn 'A' gas/gas condensate project came onstream in February 1995; Wanaea/Cossack (oil) were commissioned in November 1995, while Wandoo and Stag are scheduled for this year. (Approvals continue to flow in the Timor Sea area too – the latest being Elang/Kaktua for BHP.)

In 1995-96, the drilling of 20 wildcat wells resulted in 'significant' discoveries such as Wonnich and Agincourt but it is Laminaria/Corallina and Cornea that show how adrift geologists have been in the past. Their discovery would appear to cast doubt on the forecast, made as recently as last November, that Western Australian oil production will decline 'rapidly' early next century.

Nevertheless all, including Cornea whose reserves are currently estimated at around 500 million barrels, fall a long way short of the Bass Strait fields in terms of kick-off size.

The technical success rate for exploration wells on the North West Shelf is 25 percent, while 16 percent are deemed commercially viable.

An important key to unlocking the latest oil finds on the North West Shelf has been 3D seismic, which both Woodside and Shell have utilised to particularly good effect.

'The beautiful thing about Cornea is that it's very shallow – about 800m to the oil zone. And it's in 70m of water. This means cheap drilling,' said Mr Fraser. The reservoir's crude is also middle of the road – believed around 28° API – and is sweet.

Early indications are that Shell has chalked up a 500 million barrel find but a great deal more delineation work will be required before a reasonably accurate estimate is possible. 'If it proves up to be as good as we suspect it to be, then Cornea demonstrates that there is a new oil province. And a discovery in a new oil province that is under-explored is going to generate a lot of interest,' Mr Fraser added.

New exploration blocks in the Bonaparte Basin between Cornea and Sunrise-Troubadour were released by the Federal Government last month. Shell is expected to pick up a number of concessions.

Drilling rush

There is nothing like a big find or two to spark a rush of wildcat drilling.

Woodside pushes ahead with Laminaria/Corallina

Unquestionably, the project of the moment offshore Australia is the Woodside Petroleum-led Laminaria/ Corallina twin-field development in the Timor Sea.

The £500 million scheme is expected to come onstream in 1999 and will utilise the largest floating production storage and offloading vessel ordered by any company to date.

If the speculation machine is anywhere near right about Shell's Cornea discovery on the North West Shelf, then, with recoverable reserves collectively placed in the 130-250 million barrels bracket, Laminaria/Corallina already seems modest by comparison.

But it is a milestone nevertheless, especially since the initial Laminaria oil discovery of 1994 was made in a gas-prone province. Indeed, there are several multi-trillion cubic feet wet gas finds in prolific Timor waiting in the wings for eventual development.

Although under Northern Territories jurisdiction, the project is for commonsense reasons being driven out of Woodside's offices in Perth – although it was last year confirmed that Laminaria extends across the interstate boundary into Western Australia.

Some key contracts were let late last year and a further batch are being put up for bid about now. First

The 1996 tally was just over 20 wells. This year it will be around 40, shooting up to 60 next year. Current forecasts point to 50 in 1999, based on current acreage licence applications, which carry obligations to drill. But there is a shortage of suitable rigs to execute so many work programmes.

Meanwhile, PGS of Norway is blazing a trail on the North West Shelf by shooting a speculative 3D survey and much more of this kind of activity is expected, now that the Federal Government in Canberra has cleared the way. issued late last year was the contract for Samsung in Korea to build the FPSO hull, the world's largest.

Then, in December, Woodside put the Kvaerner-Single Buoy Mooring consortium in overall charge of the FPSO side of Laminaria/Corallina, including topsides process systems, while Coflexip Stena Offshore and Perth-based Asia Pacific and JP Kenny Pty Ltd secured design of the subsea facilities and procurement of associated long-lead time items.

Sedco has bagged the drilling programme for its 703 semi-submersible. Five subsea wells will produce from Laminaria and two from Corallina. About to come up for bid are:

- The fabrication contract for topsides process facilities
- Subsea equipment including control systems, production manifolds etc
- The FPSO mooring assembly, including turret.

Woodside also expects to secure formal board approvals from project partners Shell and BHP about now, likewise to fully complete the development plan for the sister fields, which lie in 360-420m of water.

The FPSO will be equipped to process up to 170,000 barrels of oil per day, which is significantly more than the estimated 140,000 b/d peak

Mr Fraser had been pushing for this for many years. His dream is to progressively quarter the North West Shelf using 3D seismic in a bid to improve the understanding of the area's geology and resources potential.

Likewise, he would like to see the largely untouched gap between the North West Shelf and Timor plugged with systematic surveys; similarly, to work southwards from the shelf to the Perth Basin and, eventually, around the corner to the Bremer Basin. This takes no account of what could be in store onshore where very production from Laminaria/Corallina. This will allow ample scope for future tie-ins of other fields in the locality.

As far as can be judged, Laminaria and Corallina are not materially affected by the latest and contentious agreement between Australia and Indonesia to the north over the Timor Sea Zone of Co-operation (ZOCA).

For years, the neighbouring nations had been bickering over how to split the Timor Sea, also some waters claimed to come under Western Australian control. It is understood that the various Timor Sea big gas finds and Laminaria/Corallina forced the two sides together around the conference table.

A seabed boundary treaty was signed between the two parties in 1971, but this excluded a 129-nautical mile gap between Australia and East Timor, then a Portuguese colony. This was annexed in 1975 by Indonesia.

A ZOCA compromise was initially reached in 1989 and, in March, a deal was formalised, which made local headlines not least because of the subsequent storm of protests.

For Western Australia, the biggest loss appears to have been the Bayu/Undan gas/gas condensate discovery.

little exploration has taken place.

Five of the seven major sedimentary basins in Western Australia are known to have oil, condensate and gas reserves, with offshore production largely centred on the Perth and Carnarvon Basins, plus the northern edge of the largely onshore Canning Basin.

The Bonaparte Basin also figures, boosted by BHP's confirmation that the Laminaria reservoir, which lies within the North West Territories jurisdiction portion of Timor, extends into Western Australian waters.

In some ways, however, the great

LNG tanker, destined for Japan

enigma lies onshore where, for example, there is limited production from the Canning Basin. But activity has been running at a very low ebb of late, though Shell's Looma 1 oil discovery last year offers some encouragement.

Mr Fraser said, 'On mainland Western Australia, there are sedimentary basins that could swallow the North Sea, Alberta and California. There have been a few wells poked into the ground here and there, but that is all. This is because it is cheaper to explore offshore. Although drilling costs are higher, seismic is cheaper. Besides, offshore is already proven in terms of hydrocarbons.

'What I'm saying is that, yes, there is a lot of optimism on the North West Shelf, but one shouldn't overlook the mainland,' added Mr Fraser.

Third resource boom

The approach by Western Australia has been and will remain more measured and quite akin to the Norwegian way. Acceleration in terms of activity and levels of investment is intended to be gradual as the state wants to avoid the boom-bust cycles that have dogged its economy in the past.

But there is no escaping the word 'boom'. Western Australia is officially in the midst of its 'third resource boom' – oil. The first bonanza was the gold klondike of the 1890s and the second was the minerals mining boom of the 1960s.

For Mr Fraser, the measured approach initially posed something of a personal dilemma. He originally sided with the multinationals' viewpoint – to grab as much as possible while the going was good. 'For a long time, I was with the industry and that indeed was my philosophy. Let's get more acreage. Give us more acreage, was my approach.

'With government, you come to appreciate the other side of the coin. If you put all the acreage up at any one time, you'll get a burst of interest, but what do you do after that. You don't want just one big splurge. You have to look further down the track and not



give resources away at bargain basement prices,' he commented.

State policy

This is why Western Australia makes twice yearly releases of exploration acreage offshore and invites companies to bid for 'designer blocks', of course capping allocations to curb greed. Onshore, the approach is to gazette the entire state every quarter and not to place time limits.

What sets the petroleum sector apart from the other earlier booms is that it is not just focused on extraction. It is also increasingly moving towards primary and secondary processing (liquefaction and refining), and on adding value to other minerals.

Put simply, Western Australia is taking the value-added route and the decision to deregulate the energy sector, effective 1 January 1995, has helped that process. Competition leading to cheaper gas has already fuelled the construction of pipelines by the private sector, in particular the ambitious Goldfields Gas Transmission (GGT) trunk pipeline and the smaller Pilbarra Energy Project (PEP).

The existing state-owned line feeding North West Shelf gas to Perth and points further south is a sell-off candidate and another new private sector north-south trunkline is being actively discussed, though an application by PGT Australia has suffered some setbacks. The company is, however, confident that it will win through.

Mr Fraser said the state monopoly approach was probably the right one when the North West Shelf was new and where the only real market then lay far to the south in the Perth area but times had changed. Another chapter has opened in Western Australia's energy book.

Egypt – worthwhile desert finds

By Kim Jackson

A lthough Egypt has a long history of oil and gas exploration and production, it remains a vast underexplored region with excellent opportunities and large upside reserve potential. Attention has centred on the Gulf of Suez and the Western Desert which has recently experienced an upsurge of activity with a number of discoveries made in the past 18 months.

The following paragraphs highlight some of the projects currently under development onshore Egypt and outline the plans of some of the main players in the region.

Largest leaseholder

Apache Corporation of Houston, Texas, is the largest leaseholder in Egypt with a 75 percent stake in the onshore Qarun concession and 50 percent interests in both the onshore East Beni Suef concession, located south of Qarun, and in the Darag block situated in the northernmost part of the Gulf of Suez, as well as 40 percent stakes in the onshore Khalda and Khalda Offset concessions to the northwest.

The company has achieved considerable progress over the past year, ramping up total daily net oil production in the country to more than 14,400 barrels compared with less than a thousand barrels at the start of 1996. Last year proved particularly successful with the discovery of four new fields, including that revealed by the discovery well at Wadi El Rayan on the southern part of the Qarun concession which flowed 950 barrels of oil per day (b/d) from the Abu Roash 'G' formation. Located some 56 km from the nearest production, the well has opened up a new geologic area to additional drilling opportunities. The discovery was confirmed last month with a 1,764 b/d appraisal well and early production from the new field is expected to begin this summer.

The Qarun SW field, too, was discovered in the third quarter of 1996 with the drilling of the SW Qarun-1X well which flowed 4,400 b/d from the Kharita and Lower Bahariya formations. Due to its proximity to recently completed production facilities and a pipeline, the discovery is expected to come on line before the end of this year.

Apache also reached an agreement in January 1997 to assume Mobil Corporation's interests in three Western Desert exploration concessions comprising 7.7 million acres. Under the agreement, Apache assumed a 50 percent interest in the East Bahariya concession, a 33 percent stake in the West Mediterranean Block 1 concession and a 25 percent holding in the NE Abu Gharadig concession. The concessions carry a total drilling obligation of 11 wells over the next three years.

Three other concessions – Ras Kanayis and Ras El Hekma on the Mediterranean coast and Asyut, south of and adjacent to East Beni Suef – are pending government approval and will bring Apache's gross acreage position in Egypt to a total of 28 million acres.

Khalda interests

Much recent activity has focused on the Khalda concession. Some 50 percent of contractor interest in the concession is held by Repsol of Spain, Apache holding a 40 percent interest and Samsung the remaining 10 percent. The concession is operated by Khalda Petroleum Company, an Egyptian corporation jointly owned by the contractor group and the state-owned Egyptian General Petroleum Company (EGPC).

A number of gas discoveries were made on the Khalda concession in the third quarter of 1996 including the Salam SW-1X well which flowed 49 million cubic feet of gas (mncuft) and 2,119 barrels of condensate per day from the Alam El Bueib 5A and 5B sands, while the Shams NE-1 well tested at a daily rate of 40 mncuft of gas and 1,177 barrels of condensate.

Furthermore, just last month, the Khala partners reported the highesttesting well to date on the concession: the Shams-2X well flowed at an aggregate daily rate of 104 mncuft of gas and 1,606 barrels of condensate from the Ras Qattara and Khataba formations.

Gas deal in the pipeline

In January, the Khalda partners signed a 200 mncuft/d contract to supply Khalda natural gas to Egypt's national grid system. Deliveries under the 25-year takeor-pay deal commence on 1 May 1999 and will be transported via a new 145-mile long, 34-inch diameter pipeline running from the field to Ameriya on the north coast. The pipeline will be built by a consortium consisting of Royal Dutch Shell, Repsol, Apache and Samsung and will be operated by Shell. Total contracted volumes to be delivered through the line amount to approximately 4 trillion cubic feet (tcf).

Unlike gas prices in the United States, those in Egypt are tied to the heating equivalency of certain grades of crude oil which ultimately translates into more attractive, stable prices, according to Apache. Based on oil prices at the time the contract was signed, the company will receive a gas price above \$3 per thousand cubic feet of gas. Apache's share of future deliveries from Khalda will be some \$1.2 billion, 75 percent of which would be contracted under take-or-pay provisions.

Two gas processing plants capable of



processing a combined 300 mncuft of gas per day are also to be constructed – one in the Salem area, the other in the Tarek region – to service the new agreement.

The Khalda partners also have engineering studies underway for a possible second gas pipeline that would connect the Khalda concession

with existing facilities to the south and east. Such a pipeline could accelerate sales from the area by as much as one year, states Apache.

Investment plans

Apache expects to invest some \$123 million in Egypt this year, a substantial increase on the \$55 million spent in 1996. Some 41 exploratory wells and 21 development wells are planned – 19 exploratory and 6 development at Qarun; 12 exploratory and 15 development at Khalda and Khalda Offset; and two each at Darag, East Beni Suef, West Mediterranean; East Bahariya and NE Abu Gharadig.

Meanwhile, Repsol – the third largest oil company in Egypt with a net production of over 30,000 b/d from the onshore Khalda, Umbarka and South Umbarka and offshore Gulf of Suez East and Gulf of Suez West concessions – states that it plans to invest some \$500 million in developing its Egyptian portfolio over the next five years.

Royal Dutch Shell also holds a number of interests in Egypt, its main focus centred on the Obaiyed development in the Western Desert, some 300 km to the west of Alexandria. The company recently signed a gas sales agreement with EGPC for the supply of some 300 mncuft/d from the field from the second quarter of 1999. Gas and condensate production will thus be doubled by 1999 to 6,000 mncuft/d and 50,000 b/d respectively. The field will be connected to the planned gas pipeline linking the Khalda group of fields to Almeriya on the north coast of Egypt (see earlier).

Shell reports that total future development investment will be in the region of \$570 million with first gas production expected in the second quarter of 1999. Thereafter, during the production phase, a further \$90 million is planned to be invested and 21 production wells drilled. The project will be run and managed from within Egypt by Bapetco, a 50:50 joint venture with EGPC.

Shell also holds an interest in the Matruh offshore block, awarded by EGPC in November 1996 for an initial four-year period. While the acreage covers some 13,922 km² of mainly deeper offshore terrain, there is also a narrow shelf and a small land portion to the west of the block that is located to the north of the onshore Obaiyed and Matruh development leases. Both the offshore and land portions are subject to separate production sharing terms. Work obligation during the initial period is for one well and seismic work with a financial obligation of \$7.3 million. Shell Egypt will act as operator with 51 percent equity, partnered by Shell Austria with 49 percent.

Shell is also involved in the Bapetcooperated onshore Badr el Din/Sitra producing fields in the Western Desert through its Shell Egypt and Shell Austria subsidiaries as well as the NE Abu Gharadig exploration acreage, of which Shell Egypt is operator (partnered by Pecten Egypt). The company also has a 40 percent interest in the Rosetta exploration acreage offshore the Nile Delta.

Smaller players in Egypt include Pennzoil Exploration and Production Company, the wholly owned subsidiary of Houston, Texas-based Pennzoil Company. Pennzoil was awarded block E, the West Beni Suef exploration block in January. Subject to ratification by the Egyptian parliament, the company has committed to spend \$7 million on acquiring 2D seismic on the block and drilling three exploration wells within three years of parliamentary approval. Pennzoil also has interests in four blocks located in the Gulf of Suez. Together, its five blocks cover some 9.2 million acres.

New refinery planned

Reflecting the continued growth of oil and gas activity and energy projects in Egypt, a new refinery is to be built in Alexandria. Scheduled to start production in the year 2000, the \$1.2 billion Midor refinery will have an annual distillation capacity of some 5 million tonnes. The plant will be equipped with atmospheric and vacuum distillation units, a hydrocracker for medium distillates, isomerisation, continuous catalytic reforming, desulfurisation, coker and sulfur recovery.

Strategically located with connections to the Suez-Mediterranean pipeline, the Alexandria port oil terminal, the local network of LPG storage tanks and loading station for tankers and the EGPC El Ameriya refinery, the new refinery will be able to serve Egyptian and Israeli markets and fur-

ther afield. It is estimated that up to 30 percent of output could be exported.

Midor was originally to be 40 percent owned by private Egyptian real-estate group H Salem, 40 percent by Merhav (a private Israeli trading and project development group) and 20 percent by EGPC. Repsol was to act as operator of the refinery, supplying crude oil and feedstocks and marketing products. The agreement was also to grant Repsol a purchase option on 10 percent of Midor capital equity.

However, earlier this year the Egyptian government decided to increase EGPC's equity from 20 percent to 60 percent in order to obtain the full financial resources needed for the project – the Israeli partner Merhav had been experiencing a number of financial problems. The remaining 40 percent is now split between H Salem and Merhav, while Repsol retains the option to participate in the shareholding.

Future outlook

While Egypt has a number of excellent oil and gas development opportunities and large upside reserve potential, development of its gas reserves in particular have been hampered by the lack of access to markets and the associated difficulty of arranging gas sales contracts. However, as the recently signed gas sales agreements mentioned above indicate, the tide is beginning to turn. Indeed, the policy of the Egyptian government is to replace as much as possible of its domestic oil consumption with natural gas principally to boost oil exports and much needed foreign exchange earnings. Figures in the BP Statistical Review show that domestic consumption of oil has dropped from a peak of nearly 24 million tonnes in 1990 to 21.7 million tonnes in 1995, while natural gas consumption doubled between 1987 and 1995.

The prospect of exporting supplies to Israel, or indeed through any potential new pipeline traversing the region such as the 'peace pipeline' proposed some two years ago by Agip to carry Egyptian gas to the eastern Mediterranean market, remains uncertain in light of the current political problems in Israel.

Investors flock to Venezuelan bidding rounds

he Venezuelan government has disproved the longcherished oil industry mantra that low tax rates attract private sector investors. At a time when most company managements feel they need to collect balance sheet assets at any price, Venezuela is ensuring that it remains the upmarket not the bargain basement investor target. Despite offering some of the most punitive and complicated fiscal terms worldwide, a near certainty that taxes will rise in the future and state oil company control of the joint ventures' operating committees, oil investors of all sizes cannot keep away. The third marginal field reactivation round, launched late last year, attracted a staggering 259 companies, both foreign and local, which prequalified to bid.

By Maria Kielmas, Editor, Latoil

Reserve base

The key to success is reserves. Venezuela holds Latin America's greatest volume of oil reserves in which foreign investors are eager to gain a stake. In 1996 state Petroleos de Venezuela (PdVSA) recorded conventional reserves of 72.57 billion barrels, an increase of just over 6 billion barrels from the previous year. The increase came from the transfer of heavy reserves to the conventional oil account rather than from major new discoveries. It corresponds to reserves involving joint ventures between PdVSA operating subsidiaries and foreign oil companies which will upgrade the heavy Orinoco crude to higher API gravities. The heavy oil belt, which is attracting a slow but steady stream of potential investors, holds 263 million barrels in reserves. But as the companies flock to Venezuela, so Latin America's problems flock to them. Hijackings of oil industry supplies by criminal gangs are on the increase. Both Venezuelan and foreign oil professionals have been kidnapped in the border region with Colombia. And a major question remains over the course of the Venezuelan economy. Should a recent tripartite accord between government, business and the trade unions over wages and benefits trigger a sharp rise in inflation, as many pundits have predicted, this will impact directly on oil company taxbreaks which are paid and accounted for in the local currency.

Keen foreign interest

The enormity of industry interest in Venezuela became apparent with the result of the country's first round since the 1975 nationalisation. The round was launched in mid-1995 with the bidding taking place in late January 1996. The first day of bidding generated \$125.2 million in cash bonuses of which \$104 million was paid by a consortium comprising Mobil, Veba and Nippon Oil for the La Ceiba block. The record cash bonus payment came from a BP-led consortium, which included Amoco and the YPF subsidiary Maxus, paying \$109 million for the Guarapiche block. In total, the round netted \$244.9 million in cash bonuses for PdVSA. The companies could afford to bid so high as these bonuses are tax deductible in the case of commercial production.

This success whetted corporate appetites for the third field reactivation round, which PdVSA called the third operating round. After some prevarication, ostensibly due to the difficulty of drafting new bidding terms, the round was formally launched in November last year. Some 20 blocks were offered for bid. Oilfields offered for reactivation were demarcated by given boundaries, while contractors are able to conduct exploration outside these areas at their own risk. Five of the blocks were reserved for Venezuelan companies on preferential terms. After the first two field reactivation rounds and the exploration round, Venezuela's legislatures criticised the lack of local company participation in the country's oil opening and successfully pushed for a special deal on national companies. Speculation that the government would provide a special deal for its nationals, even though there was a danger that this could be interpreted as discriminatory according to the rules of the World Trade Organisation, prompted a number of foreign operators, especially USbased companies, to create Venezuelan fronting companies as an avenue to easier exploration terms.

Jack-up in the Maracaibo Lake



Stiff terms

The terms of the round defined a local company as one with a history of professional and commercial operation in Venezuela. In the case of a recently created company this could be satisfied by the professional record of the company's personnel. In addition, at least 80 percent of the company's capital must be held directly or indirectly by Venezuelan nationals. If a given company's shares are publicly traded, the principal securities exchange on which this takes place must be Venezuelan. Venezuelan government officials agreed privately that this definition was broad enough to accommodate some of the aspirations of US investors who wish to use Venezuelan nationals as fronts when bidding for the round.

In addition to the preferential terms for nationals, this third marginal field

round differed from the previous two in stipulating a cash bonus requirement in bidding. There will also be a 10 percent back-in to commercial production by the soon-to-be-launched petroleum investment funds, a form of mutual funds to be traded on the markets. capital Venezuelan Presentation of the Byzantine fiscal and legal terms at the round's launch left oil executives gasping in disbelief. But PdVSA asserted that, since these allow profits to increase in line with oil production in excess of a pre-determined production baseline (specially calculated for each block) the terms will provide incentives for contractors. But industry analysis of the terms has indicated that they are similar to those of a production sharing contract but using internal rates of return as the tranches rather than production volumes. This in turn indicated a de

facto cap on potential profits.

For their trouble contractors will receive a single service fee quarterly as a payment, and for which the contractor bids. During the adjudication, PdVSA awards more points to those bids which maximise its own revenues, ie the lowest service fee. According to the official information, this is designed to reimburse contractors' costs and to provide an additional incentive based on each field's pre-tax rate of return. The contractor will also receive an amount to cover costs of the baseline production. He will be required to fund all costs related to the conduct of operations under the agreement. These costs will only be recoverable to the amount of the service fee and will not be recoverable if the service fee is insufficient. Thus in theory, a low service fee on the part of a potential contractor could mean that at some stage he may

end up paying money to PdVSA. Some countries, such as Iran, have foreseen this situation when launching field reactivation offers and have provided a facility known as 'top-up oil' to ensure the contractor makes a profit. Increasingly popular Venezuela has no need to offer such incentives.

Lucrative sale

Up to now PdVSA has earned \$16 million from the sale of third round data packages and initial bidding fees alone. The award of acreage was due to take place in a public ceremony in May but this has been postponed until the first week of June. However, many uncertainties remain, such as the issue of municipal taxes, depreciation rules, the lack of dollar accounting (promised by the government but not forthcoming) and the real threat of additional municipal taxes. The municipal tax question awaits a judgement from the Supreme Court. PdVSA sold the third round to local politicians on the promise that it will develop local economies. The tacit hope appeared to be that the Supreme Court judgement would be a long time in coming. But some municipal authorities have been known to resort to extortion to obtain those funds they do not receive in taxes. Oil companies have been expressing their worries publicly. But given the popularity of the deals, such cries are bound to fall on deaf ears in government. As in most Latin American countries, foreign companies in Venezuela are welcome for their investments but they do not have any political clout. One former government official said privately that he warned PdVSA management that the terms for the third round were too severe and that investors would stay away. But PdVSA did not listen, gambled for high stakes, and seems to be winning.

High inflation

Companies received some tax respite earlier this year when the government removed a 16.5 percent wholesale tax for imports by major oil and industrial

investors. But the proposal stipulates that the tax first must be paid and then will be reimbursed. This is expected to be a time-consuming process during which the money could be eroded by inflation. Last year's inflation rate was 103 percent. This year the government target is 25 percent. But a January 105 percent wage increase to public sector medical workers exceeded the budget plan and set a precedent for other public sector workers. The government later agreed to other public sector wage rises of between 40 percent and 100 percent. February's tripartite accord between government, business and unions managed to stagger Venezuela's extremely generous severance payment system and double the minimum wage. As a result the latest goal of 40 percent inflation this year is beginning to look unachievable. The upshot for oil investors is that the removal of the 16.5 percent import tax could be largely neutralised.

The inflation threat could also have severe implications for PdVSA's ambition to raise investment funds from the local capital markets. A suggestion by PdVSA President Luis Guisti that a tranche of the company's non-voting stock could be sold, the system under which Brazil's Petrobras works, was rejected by the government. The alternative was some financial instrument, duly emerging as the petrobond. The company launched the first of these fixed-rate petrobonds in February on the local markets to a strong popular response. The bonds are a precursor to three types of oil investment fund, planned for launch later this year. The petrobond sale was limited to 20 million bolivares (\$42 million) from an initial planned Bs30 million after small investors had bought up Bs17.5 billion. Individuals were allowed to buy bonds between Bs100,000 and Bs1 million. These carried a 12.5 percent interest rate which looked good compared with the 6 percent rate on mediumterm dollar deposits in a Venezuelan bank but substantially below projected (so far) inflation of 40 percent. The bonds carried a put option, enabling them to be sold back at face value.

The investment funds are expected to attract larger, institutional investors, These will be of three kinds. The first will consist of a 10 percent stake in the 20 third-round marginal field ventures. The second will consist of up to 5 percent shares in the heavy crude projects. This one will be more difficult to organise as most of the projects are still in their feasibility study stages. In addition, returns on these projects could be quite low. PdVSA has been trying to address the question through proposing a decrease in royalty rates. At the moment these are 16.5 percent, the same as for ventures involving light and medium grade crudes. A proposal to lower royalties to 1 percent has been studied in congress during its deliberations on an Orinoco Belt venture between Corpoven, Arco and Phillips. The congress noted that relief from royalties would only be valid if the life of the project could be extended. The third fund will include 10 percent stakes in the exploration contracts. At the moment these are expected to be brought together in one portfolio.

Worsening risks

As more foreign oil companies move to Venezuela, so kidnapping gangs connected with Colombian rebel organisations move in after them. Colombian rebel incursions into Venezuela have increased sharply recently prompting stiff protests from Venezuela. Colombia replied with revelations that deserters from Venezuelan armed forces have joined Colombian rebel groups such as the Ejército de Liberación Nacional (ELN) and that the rebels buy substantial quantities of weapons from the Venezuelan army. Now a secondary kidnapping market has arisen. Recently the Colombian military announced that a group of foreign criminals, including Europeans and Americans, have purchased several people kidnapped on the border with Venezuela with the intention of selling then back to their countries of origin. At the time of writing one US and one Venezuelan oilman were being held hostage on the border.

A personal perspective on drilling onshore in the United Kingdom

recent IP Aberdeen Branch meeting addressed the subject of onshore drilling. The response was unexpectedly enthusiastic because most of our well operations members are engaged in offshore work. Whatever the reason there is no doubt that onshore work has in the past been challenging and important and, bearing in mind BP's Colombian experiences, still has its moments. Those of us who joined the drilling industry pre-North Sea thought that our lives would be spent on land rigs and because of the clear differences in work continuity (we worked three weeks on and one week off, with one month's home leave after working overseas for one year), our training/ work experience was much more concentrated. Times have moved on and so have rigs and equipment.

By P J Redman, Managing Director, Midmar Energy

The Aberdeen Branch also heard a speaker on extended reach drilling. The methods now used to drill directionally are impressive, particularly methods such as rotary steerable drilling systems which allow hole angle and azimuth changes or corrections without the hazard of a stationary drill string. The use of this type of equipment must be justified by high or potentially high rates of production. Onshore 50 barrels/day (b/d) wells will not cover it, at least not for the next 10 years. Such wells must be drilled cheaply but methods employed in other parts of the world, notably south or west Texas, are not applicable in the British Isles. We must comply with environmental restraints and adapt our drilling operations in order to result in an economically viable project.

It is relevant when discussing onshore to look briefly at its history. In 1929 BP geologist C M Lees was asked to look at onshore exploration in the United Kingdom following a very small discovery drilled at Hardstoft, Derbyshire in 1919. A further 10 years passed (the pace is breathtaking!) before oil was discovered at Formby, Lancashire in 1939 and came on stream the same year. Within months the most significant discovery to date was made at Eakring in Nottinghamshire.

This was fortuitous because Britain went to war in September 1939. The country's need for indigenous crude was obvious and the government set a high target of 2,000 b/d, against the 500 b/d rate of 1940. BP imported American drilling personnel to drill the necessary production wells because local staff were away fighting the war. The 2,000 b/d production rates were reached by September 1942 and a statue depicting an American drilling crew member with the inevitable 36-inch pipe wrench was raised at Eakring (see *Petroleum Review*, September 1991).

UK onshore operations

UK production of crude oil last year averaged 2.57 million b/d. Of this total, only 107,000 b/d came from onshore of which 100,000 b/d were produced by BP at Wytch Farm, with the other 7,000 b/d at the other onshore oilfields.

It must be borne in mind that a lot of the regulatory requirements that rightly apply to offshore also apply to onshore with the inevitable extra cost. In addition, planning permissions involving local authorities as well as the Health and Safety Executive (HSE) must apply and their requirement can be particularly onerous. Why does any company bother? The answer is that small fields can produce a profit but not with the costs and overheads that have been applied to them in the past.

Drilling process

The sequence of events in drilling an onshore well is as follows:

Pre-drilling tasks Having identified a prospective structure, it is necessary to find a suitable drilling location preferably on level ground easily accessible with a good road nearby which will allow the transportation of heavy loads often of excessive width. Hopefully the nearest human habitat is 5 miles away or better still 50. The area should be at a reasonable elevation above groundwater level but not on a hill. At the same time the availability of water nearby is important. In addition, the operator hopes to access land belonging to a 'reasonable' land-owner. The

Well 6 at Stockbridge oilfield



scouting must be done in 'confidential mode' as it is surprising how land values rise when an oil company, no matter how small, is known to be interested. When such a site has been identified, it is important to reach an understanding with the land-owner quickly.

An outline drilling programme must then be put together for presentation to the HSE and on receipt of their preliminary approval we can make application to the County or similar Planning Authority for planning approval to drill the well. Without planning approval the HSE will not grant final approval for the well to be drilled. Planning authorities will require meetings both private and public with the operator's staff. These meetings can be very difficult because the general public's perception of our industry is, unfortunately, not good. They may still see us in the manner of the Wild West, tearing up the countryside and causing fearful disturbances. They are surprised to learn that we are very ordinary people, much like themselves.

Pre-planning and approvals will generally take around a year. Obviously it all costs money. However it is essential that proper control is kept of this and any other work in our green and pleasant land. An Environmental Impact Assessment (EIA) is extremely useful and may be mandatory.

Site construction To drill an exploration well (2,000m is typical), we require a site measuring 80m x 60m. Construction would consist of removal and careful storage of top soil, which will be replaced if it is a dry hole, excavation of waste pits and of the well cellar measuring normally 2m x 2m. The site is then excavated to firm ground; an impervious membrane of leakproof Terram is laid over the whole site to avoid toxic materials, diesel oil, drilling fluids from leaking through and contaminating the land. A ditch is constructed around the whole site to contain fluids and vacuum tankers are employed to remove fluids, if necessary. In wet weather a lot of the removed fluids will be rain water. Another expense.

Hard core is applied above the Terram membrane to a thickness determined by the operator but, in many cases, stipulated by the Local Authority. Obviously the thicker it is the more the transport and building costs. The cellar is normally cemented and cement plinths are installed to house heavy machinery. These plinths are often bunded to contain local spill such as engine oil.

In addition to this work, water supply lines and septic tank facilities will be installed for personnel living on the site. Costs vary but £70,000 to £100,000 could be taken as an average.

Drilling operations and testing The pre-planning normally associated with offshore wells applies equally to onshore, with the obvious exception of





providing helicopter and boat services. In their place we must provide adequate road transport including transportation of the rig, although this is normally included in the drilling contract.

Drilling programmes have to be prepared as well as authorisations for expenditure and the selection and procurement of materials and services. Selection of supervisory and engineering personnel is also land specific. Although there are many similarities, the two types of drilling operations are quite different. A person who has only operated offshore will find difficulties running a rig onshore. One clear difference is that the offshore operation is extremely well supported because of the costs involved. Onshore support results in a drilling supervisor doing many jobs his offshore counterpart would never consider. How many men offshore cook for themselves? However a good offshore drilling supervisor will invariably make a good onshore one.

The other striking difference is the limited rig power. Offshore with 3,000 hp rigs the drilling supervisor tends to take for granted that the rig power supply will respond to any power requirement for which he calls. Onshore a 700 hp rig is big and in a deviated tight hole, power limitations can be a problem. These comparisons show the differences but the main difference is one of cost. Offshore the money is available because the expenditure in general terms is justified; onshore it is not.

Technically, onshore drilling operations are pretty straightforward, although the above examples can make for problems. Hole sizes are standard though we try and avoid 26-inch hole. Mud systems are simple with little time or money for such things as pseudo oil base muds. Slim hole is being utilised more and more, although it is understood that ultra slim hole as depicted by a Swedish company is no longer fashionable.

Testing operations offshore are complete work periods, very carefully planned, and resulting in high daily costs for rig operation. With modern equipment there should be nil spillage and minimal environmental impact. In fact other than worrying about the heat generated, it must be pleasing to seamen who pass by to see the flare lighting up the sky.

Onshore this is not the case and there is a distinct danger that we will be accused of burning up the local countryside. Spillage is unthinkable and resultant gases from flare operation frowned upon. Testing programmes are of limited duration, with flare periods normally kept to daylight hours. A flare pit is constructed in the direction down wind of the prevailing wind and a burning line is laid to it. It is good practice to inform local residents that a fire glow will emanate from the site. This often avoids unnecessary call-outs for the local fire brigade.

Production facilities Unlike offshore, onshore production rates, other than Wytch Farm, cannot sustain expensive production facilities. At the same time environmental concerns mean that certain procedures not necessary offshore are required onshore with added expense. For example, the camouflaging of tankage or design of unobtrusive facilities often mean that proven and well-tried methods need to be modified to suit onshore.

Another intangible is that many production engineers trained offshore 'think' North Sea. A Magnus or Beryl, a Brent or a Scott can stand a good deal of production facilities but a Singleton or Palmers Wood is a different situation. A stock tank in the corner of the location, as in the United States, would really be the answer but onshore UK is not as easy as that. Meanwhile, the objective is to design 'horses for courses' within a very tight budget.

Environmental impact Those of us who started work onshore UK in the 1950s were issued with hard hats (optional), overalls and heavy duty rubber boots. The latter item was essential since in wet weather sites were literally a quagmire. Metal grating was laid to allow vehicles to cross the site. Drilling mud, diesel oil, engine oil and other toxic materials were spilt on the site with impunity. We once unintentionally poisoned a herd of dairy cows when 50 barrels of diesel oil (to be used in an early attempt at oil based mud) was lost and ended up in the cows' drinking water. Environmental awareness was almost zero. Pollution both chemical and noise was commonplace.

In those days, a farmer was paid the princely sum of £50 per year for a couple of acres. This was paid until he cropped or grazed the field again. BP would even repair, install or replace fences on these fields! Today with EIAs and careful procedures, we are moving in the right direction, even if the added expense is painful.

One serious problem with onshore drilling is noise pollution. The standard is that the total noise level generated by the rig and all equipment is 35 decibels at 300 metres distance during daytime. This in practical terms is quieter than the noise of a normal speaking voice. Most modern land rigs are silenced – more expense.

Costs In 1984 directional wells at Humbly Grove were costing approximately £1 million. People like Graham Ross and Joss Russell worked very hard to reduce costs and it is to their credit that the cost of Humbly Grove deviated development wells was reduced to around £470,000. This type of achievement requires personal involvement to an extent which is understandably not often seen in very big companies.

We know only too well that these costs are minimal compared with offshore but, at the risk of offending people, it is believed that offshore costs can be cut further by taking certain lines of action.

Life with capercaillie

Every driller dreams of owning his own rig. For me this dream came true when I owned a rig called Capercaillie, named after the Scottish game-bird. I am told that you have to be mad to own a drilling rig. I can understand that sentiment! At the same time when she is rigged up for the first time on a paying location, the pleasure of walking up the steps of your own drilling rig is an experience not to be forgotten.

However, there can be problems. I believe its easier to run three rigs rather than one – the main pressure is when the rig is stacked (not on paying work). In those circumstances you have a mass of iron costing money but not earning a penny.

Our first job was a workover at Stockbridge. The rig was sufficient but somewhat sparse in spares, tools etc. The young company engineer thought it should be tooled up like the Sonat Rather. Only thing was he was not paying a Sonat Rather's day-rate.

Later in order to keep the rig working, I took a rash decision to carry out a full turnkey operation. We built the site, mobilised the rig, rigged up, spudded and drilled to terminal depth. We supplied all the services including a basic suite of electric logs. The deal was, no payment unless we drilled to terminal depth and logged the hole. Sure enough 150ft off terminal depth (TD) in very hard drilling, we twisted off. To side-track would have been a long and arduous business. I have never concentrated on a fishing job so carefully, since the payment depended on it. We recovered the fish on the first attempt and drilled to TD, logged the hole and invoiced for the single sum of money. Thirty-five days later they paid us. We actually made some money.

We did other drilling and workovers. In Spain we drilled a dry hole 113 km northeast of Madrid and then moved the rig back to the United Kingdom. Not long after that a Middle Eastern company offered a good price for the unit, so I sold up and returned to my previous status as a driller.

Onshore prospects

In 1985 there were 43 exploration/ appraisal wells and 24 development wells drilled onshore UK. In 1995 two exploration wells and 19 development wells were drilled. Last year was no better, with just two rigs running.

With better oil prices, there is still money to be made onshore but we have to take an innovative look at how we will go about making it. We need to look at drilling, testing and production methods in a new light. A leading land drilling contractor recently described the present state of the land drilling industry as 'disastrous'. He has decided to withdraw from the European market and concentrate on his North American interests.

A contributory factor is that with improved technology it now takes only 15 days to drill a well. Drilling times have been reduced but dayrates have remained much the same. In addition drilling programmes often consist of single wells and to pick up a rig and lay it down again for 15 days is unrealistic unless day-rates are much, much higher than at present, or some other way of working is found. Rig repair and maintenance costs are very high. To be viable, a contractor needs a continuous programme for two or three rigs. The oil companies argue that there are plenty of rigs in Europe but I believe that European contractors are taking the same view as UK contractors and moving their rigs to more lucrative parts of the world.

Safe pig trap loading and unloading procedures – an interlocking project

By M J Smith, Vice-Chairman, Smith Flow Control Ltd

s a general principle it may be said that operations which are safe when performed correctly can have catastrophic consequences when performed incorrectly. The oil, gas and chemical processing industries generally have a very disciplined approach to design and operating practice governed largely by well-recognised international standards and enforced by certification authorities. The general public on the other hand has little understanding of these matters and sees only the results where these disciplines break down and an incident occurs. Then a knee-jerk reaction follows through public investigation of the circumstances often resulting in further regulation or restriction of our industry.

While good practice begins with good design, both are inevitably hostage to the 'human factor'. An abundance of statistics and case examples exist to confirm this and everyone will have knowledge of both high profile and other less publicised incidents where the human factor contributed to or directly caused accidents. The following statistics are an interesting extension of this general point:

Some 70 percent of reported incidents in the oil and gas industry worldwide are attributable to human error, accounting for in excess of 90 percent of the financial loss to the industry.

(By implication, the remaining 30 percent of reported incidents are attributable to design/equipment failure, third-party action or natural disaster – all accounting for less than 10 percent of the financial loss to the industry.)

The insurance industry has published figures stating that between October 1987 and August 1992 there were 15 individual catastrophes for which insured losses exceeded \$1 billion, of which 12 were natural disasters and three were oil industry incidents where human error was a significant contributory factor – Piper Alpha (\$1.4 billion), *Exxon Valdez* (\$1.5 billion) and the Phillips Petroleum explosion \$1.5 billion.

Risk and responsibilities

Until the Industrial Revolution, milestones in history affecting society were perceived principally as political, religious or military events. Technology evolved slowly; the first step of the power generation era was the harnessing of steam and then electricity. Then came the commercial realisation and mass production of the combustion engine with the parallel development of terrestrial communications. In the future, history may consider aviation, nuclear energy and the microchip as of even greater socio-economic significance and record all this era as the 'Great Technological Age'.

What is clear today is that in this modern age, the engineer has become the author of society's advancement but he also bears responsibilities. The UK Health and Safety at Work Act (1974) places responsibilities on people who design, manufacture or supply equipment for use at work to ensure as far as is reasonably possible that they are safe. Throughout the developed world and in particular within the European Community, the thrust of legislation is towards making all professionals legally responsible for their actions - not only in civil law but also in criminal law.

Within the oil and gas industry we should not only consider risk from the perspective of injury to persons or damage to plant but also from the perspective of protection of the environment. Indeed, the World Federation of Engineering Organisations (WFEO) has drafted an international Code of Environmental Ethics for Engineers which has been approved by European national engineering associations and UNESCO. These points all militate towards an inevitable conclusion that in this modern age where depletion of resources, huge population growth, pollution and fragile ecosystems are of growing concern, 'responsible engiwill become a byword neering' demanded by society and legislated for by authority.

Legislation versus working practice

Internationally, there are strong indications of a fundamental shift of emphasis in legislation from prescriptive regulations to the risk management approach. This latter approach places primary legal responsibility on 'own-

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BEN — MOTOR AND ALLIED TRADES BENEVOLENT FUND Lynwood • Sunninghill • Ascot • Berkshire SL5 0AJ Registered Charity No: 297877 ers' to adopt 'best available' technology and methods to ensure safety consistent with the risks identified for each operation. The United Kingdom has led the way on this principle and enacted the 'New Pipelines Regulations (1996) Act'. In the United States, Congress is expected to legislate along similar lines and other countries may follow.

This legislative trend set against the 'downsizing' internationally by oil and gas (owner) operating companies suggests a potential conflict of priorities. Operating (owner) companies are increasingly reducing their own manning levels and contracting out the operation and/or maintenance of their assets to independent contractors.

These contracting arrangements may be characterised by a higher rotation of personnel at site because they are typically relatively short-term agreements. The 'job-for-life' syndrome which produced the dedicated company man is disappearing and being replaced by higher levels of process automation and increasing dependence on 'partnering' with contractors. This 'casualisation' of on-site labour inevitably increases the risk of accidents through human error and demands higher levels of applied safety systems to mitigate this risk.

Many routine procedures are potentially dangerous if executed incorrectly or in unsafe conditions and the scope for injury and/or damage is significantly increased when high temperature, high pressure or toxic/flammable product is present.

Safety tool system

Key interlock systems are gaining increasing recognition as an effective safety tool and are recommended in a number of internationally recognised standards for specific process applications including:

- API RP 14E Design & Installation of Offshore Production Platform Piping Systems (Para.5.8.b (2) – Relief Device Piping
- API RP 520 Pressure Relieving Systems for Refinery Services (Part II: Section 4 – Isolation Valve Requirements)

- NFPA 12 National Fire Protection Association (USA) – Carbon Dioxide Extinguishing Systems –1993 Edition
- BS 5306 British Standard Part 4 1986
 Specification for Carbon Dioxide Systems
- BS 8010 Code of Practice for Pipelines (Part 2 1992 – Sect. 2.8).
- BS 8010 Code of Practice for Pipelines (Part 3 1993 – Sect. 6.6).
- 1996 No. 825 (UK) The Pipelines Safety Regulations (Section 6 – Para. 37 of Guidance on Regulations – published by UK Health & Safety Executive).

What are key interlocks?

Key interlocks are dual-keyed mechanical locking devices which operate on a key transfer principle to control the sequence in which process equipment may be operated. The hardware is relatively simple and is based on specialised mechanical locks designed as integral-fit attachments to the host equipment.

Typically they are applied to valves, closures, switches or any form of equipment which is operated by human intervention. The 'OPEN' or 'CLOSED' status of an interlocked valve or the 'ON' or 'OFF' status of an interlocked switch can only be changed by inserting a unique coded key; inserting the key unlocks the operating mechanism (eg handwheel or push-button), thereby enabling operation of the valve or switch. Operating the unlocked equipment immediately traps the initial (ie inserted) key; when the operation is complete, a secondary (previously trapped) key may be released thereby locking the equipment in the new position. This secondary key will be coded in common with the next lock (item of equipment) in the sequence. By this simple coded key transfer principle a 'mechanical logic' system is created which denies scope for operator error.

While 'car seals' or padlocks and chains provide a 'lock-off' capability, they do not provide any control of the sequence of operations, nor do they assure or confirm the status of the equipment to which they are fixed – ie removing a key from a padlock does not assure either that the equipment is locked nor its 'open/closed' or 'on/off' status. While a padlock and chain arrangement may be suitable and sufficiently robust in a lowcriticality application, 'car seals' have virtually no mechanical integrity and are a minimalist solution offering at best a visual restriction against unauthorised operation.

Mechanical key interlock systems are ideally suited for integration with Permit-to-Work (PtW) procedures. The Cullen Report on the Piper Alpha disaster (1990) strongly recommended the use of locking systems integrated with PtW procedures, especially where routine procedures cannot be accomplished in the time-scale of a single shift. In addition to the standards referred to earlier, the Technical Guidance Notes supporting the new UK 'Pipeline Regulations (1996) Act' also recommend interlocks as a suitable safety system in the operation of pig traps.

Key interlocks date back to the 1890s where they were first used in the French railway system to control track switching operations. In 1928 James Harry Castell developed the original form of modern key interlocks which came quickly into common use in electrical switchgear applications to prevent the paralleling of electrical supply in busbar systems.

Modern integral-fit key interlock systems for oil and gas processing and pipelines systems did not emerge until the early 1980s. Since then, industry acknowledgement of their effectiveness has led to their extensive use worldwide and an increasing degree of adoption within international standards and codes of practice.

Primary and secondary safety systems

BS 4778 defines risk as 'the combination of the probability, or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence'. Whether a process module is of simple design with basic functions controlled by manually operated valves or of complex design controlled by sophisticated mainframe Distributed Logic Control (DLC) systems, key interlocks can provide a totally reliable mechanical assurance of safe operating practice in which the operator's scope for error is eliminated.

Indeed, within DLC controlled systems which invariably incorporate electrical interlocking 'trips', these are limited to governing only the operation of motorised valves (MOV); associated sundry services valves (eg venting) may well be served by manually operated valves and correct operation of these valves is dependent on the operator following written operating procedures.

In such systems, key interlocks are not intended as the primary safety system but as a secondary total backup system to the primary (DLC) system. The inherent advantage with key interlocks is that being mechanical they are not power-dependent and yet may be designed to attach to MOVs without compromising their operating or failsafe function. Designs have been developed in recent years to provide key interlocking solutions that offer the only total form of interdependent control over the operation of MOVs and manually operated valves in one fully integrated system.

In process systems where the valving and/or control components are all manually operated (ie not DLCcontrolled), key interlocks become the primary safety system.

Whether adopted either as a primary or secondary safety system, the key interlock installation can be customised to intelligent format by electronic tagging of the individual keys. This is achieved by fitting each key with an ID chip which is read by a tag reader in the control room key cabinet. The key cabinet system incorporates a standard IBM compatible PC which manages the system software. This can be interfaced with the mainframe DLC system by a simple twin-wire connection.

Case example – interlocking of pig traps: safe loading/ unloading

It might reasonably be said that the singular greatest hazard associated with the operation of pig traps is the exceptional event of opening the closure, whereas launching and receiving procedures in themselves are quite straightforward and relatively safe.

DNV TN B 302 Technical Notes for Fixed Offshore Installations describes pig traps as 'primary grade sources of hazard'.

The following is a case example of an interlocked gas launcher using a simple 'linear key logic' where there are no deviations from the prescribed procedure. The vessel valves are all manually operated and the example given shows venting to atmosphere and the assumption in this case is that there is no sour gas (H_2S) or other hazardous by-products present in the process.

From an interlocking perspective it is rare to find two systems identical to each other, even where they may be adjacent to each other on the same site. Where the case example shows venting to atmosphere, the norm would be through a PSV or a drain outlet, or both and where venting/purging operations may need to be repeated several times. In such cases, a linear logic system would not apply; alternatively, a key selector device would be incorporated which controls the release/retention of the relevant process keys which the operator cannot bypass.

The case example given is sub-divided into a three-stage procedure:

- Task 1 (Figure 1) Loading: venting, and unlocking/opening of the closure
- Task 2 (Figure 2) Launching: pressurising and launch
- Task 3 (Figure 3) Depressurising: restoring to ambient/normal status.

Case example

Task 1: To load the pig.

Vessel Status: Isolated and Depressurised: Production On-Line.



Figure 1





Drain

Figure 3

- Permit Key 'A' into atmospheric vent valve to unlock and open – releasing Key 'B'.
- Key 'B' into PSV block valve to unlock and close – releasing Key 'C'.
- Residuals now venting to atmosphere.
- Key 'C' into drain valve to unlock and open to clear any accumulated liquids.
- Close drain valve again releasing Key 'C'.
- Vessel is now depressurised and venting.
- Key 'C' into closure lock to unlock and open – commence loading.

Case example

Task 2: To Repressurise and prepare for Launch.

Vessel Status: Isolated and Depressurised: Production On-Line: Pig Loaded.

- Shut closure and lock closed by removing Key 'C'.
- Key 'C' into PSV block valve to unlock and open releasing Key 'B'.
- Key 'B' into atmospheric vent valve to unlock and close – releasing Key 'A'.
- PSV now on-line.
- Key 'A' into mainline valve 'M1' to unlock and open – releasing Key 'D'.
- Key 'D' into mainline valve 'M2' to unlock and open – releasing Key 'E'.
- Key 'E' into kicker valve 'K1' to unlock and open – releasing Key 'F'.
- Key 'F' into kicker valve 'K2' to unlock and crack open slowly to pressurise.
 After substantial or complete pressurisation, open fullly releasing Key 'G'.
- Now loaded, pressurised and ready for launch.

Case example

Task 3: To Launch Pig and then Isolate and Depressurise.

Vessel Status: Loaded, Pressurised and Ready for Launch.

 Key 'G' into line valve 'L1' to unlock and permit inching to closed. (Key 'G' remains trapped during this procedure).

- Backpressure through kicker line will effect pig launch.
- Fully re-open line valve 'L1' and lock open – releasing Key 'G'.
- Key 'G' into kicker valve 'K2' to unlock and close – releasing Key 'F'.
- Key 'F' into kicker valve 'K1' to unlock and close – releasing Key 'E'.
- Key 'E' into mainline valve 'M2' to unlock and close – releasing Key 'D'.
- Key 'D' into mainline valve 'M1' to unlock and close – releasing Key 'A'.
- Vessel now isolated ready for depressurisation.
- Key 'A' into atmospheric vent valve to unlock and open – releasing Key 'B'.
- Key 'B' into PSV block valve to unlock and close – releasing Key 'C'.
 (If required, proceed to drain using Key 'C').
- After venting, re-insert Key 'C' to unlock/open PSV block valve – release Key 'B'.
- Key 'B' into atmospheric vent valve to

unlock and close - releasing Key 'A'.

 Vessel is now depressurised and isolated – Return Key 'A' to Control.

Task completed

This 'linear logic' procedure demonstrates how a key interlock system controls the operational procedures of a simple launcher arrangement by compelling the operator to abide by the prescribed sequences.

Although simple and straightforward, the system described fulfils to the letter the requirements of BS 8010 Section 2.8: 1992 (2.8.3.10 Closures) and BS 8010: Part 3: 1993 (Section 6.6 Pig Traps and Closures) as well as ASME VIII - Division 1.

Conclusion

It is hoped the process example given here has been helpful in developing the reader's understanding of the principles of key exchange interlocking and its effectiveness as a front-line safety management tool.

The examples given are typical of the many process applications where interlocks ensure safety through positive sequential control of operations and elimination of scope for operator error.

The global trend towards contracting out of site operations inevitably translates into the 'casualisation' of work-force labour which equates to an increasing risk of accidents through human error. Interlocking can significantly mitigate against this increasing risk.

Finally, an important observation to note is throughout the procedures described, there is only ever one key 'free' at any time! This is the essence of a well-designed key interlock system. Key interlock systems must always be operatorfriendly and an incestuously complex system with a multiplicity of 'free' keys will defeat the objective. Keep it simple.

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People

Monument has announced that **Mr Tony Craven Walker** will take over as Executive Chairman this month.

Mr Michael E Wiley has been elected as Executive Vice President of ARCO. Prior to his election, he was Chairman, CEO and President of Houston-based Vastar Resources, Inc., which is 82.3 percent owned by ARCO.

Mr Daniel Rappaport has been elected to his third term as Chairman of the board of the New York Mercantile Exchange, along with board members in five other categories. Mr Albert Helmig was elected to a third term in the floor broker category, and Mr Gary D Cohn was elected in the trade house category. Mr David Wender, a magna



The International Marine Contractors Association has appointed *Mr Tony Read* as its new Chief Executive. He has extensive experience of the offshore industry.

Ms Jane Bugler (below) also joins the ICMA as Technical Director. A chemical engineer by training, she has experience in the health and safety field.





Chevron Europe's Londonbased Strategic Business Unit has a new Manager of Government and Public Affairs. *Mr Stephen Colville* joins from public affairs consultancy Advocacy Ltd.

cum laude graduate from the Wharton School at the University of Pennsylvania, was elected in the local category. Mr Neil Citrone, Vice President of Pioneer Futures Inc, was elected in the futures commission merchant category, and Mr Scott Hess, a partner in G&H Commodities, was newly elected in the at-large category. Mr John Moore was elected for his second term as Chairman of the COMEX governors committee, and Mr Michael Devaney, Mr Kevin Grady, and Mr Kevin O'Reilly will all serve three years as committee members.



appointed a new manager for its southern North Sea operating unit. *Mr Eric Bell* succeeds Mr *Archie Kennedy*, who is transferring to Conoco Inc in Houston, USA, as regional co-ordinator for the South America, Africa, Asia Pacific, Middle East division.

Fortune Oil plc has appointed **Mr Napoleon Y S Chu** as General Manager for Trading and Industrial Marketing and **Mr Frank Li** as Deputy General Manager and Director of Retail Operations.

Mr John Pearson joins BZW's Corporate Finance Division as Managing Director. Formerly at Schroders, he will head a new team focusing on the global energy sector.



The Expro Group, oilfield service providers to the upstream oil industry, has appointed *Mr Stuart Reid* (left) and *Mr Richard Holmes* (right) as Client Account Managers responsible for the UKCS/Norway Region.

Mr David C Yen has been named Vice President and Treasurer of Occidental Petroleum Corporation. He succeeds Mr Fred J Gruberth, who is retiring after 24 years in Occidental's Treasury Department.

Dr Peter Cook CBE will step down as Director of the British Geological Survey in September, after seven years.

The American Society for Testing and Materials has elected its 1997 Board of Directors. They are: **Mr James E Bihr** (Chairman); **Mr James S Pierce** (Vice Chairman); **Mr Donald E Marlowe** (Treasurer); and six directors, **Mr W James Bover**, **Mr Thomas R Doane**, **Mr Joseph P Gallagher**, **Mr Robert R Hardison**, **Mr Henry Line**, **Mr Jack P Pekaar**.



Passive fire protection products manufacturer Mandoval Coatings Limited has appointed *Mr Wilf Butcher* to the position of General Manager. Mr Butcher was formerly the company's General Sales Manager.

Mr Philip Wootten joins Parker Hannifin's Instrumentation Products Division as Valves Product Manager. He was previously with Alfa Laval Saunders and Keystone.

Dr Chang-Lin Tien, Chancellor of the University of California, Berkeley, has been elected to the Board of Directors of Chevron Corporation. Mr D M Clementz has been appointed as President of Chevron Information Technology Company.



Daniel Industries Inc has appointed *Mr Barry Webb* as Managing Director of Daniel International Ltd, which is responsible for Daniel's metering business in the Eastern Hemisphere. Webb was previously Director of Sales and Marketing for Spectra-Tek International Ltd, which was acquired by Daniel in May 1996.

Technology News

Leak-free pumping of aggressive media

A new range of PTFE-lined magnetically coupled centrifugal pumps has been developed by Michael Smith Engineers as a cost-effective alternative to the metallic type sealless models traditionally used to provide leak-free pumping of aggressive media such as acids and solvents.

The QVF range of pumps has pressure bearing components made of cast iron that are able to withstand high levels of mechanical stress. The pump internals, however, which come into contact with the process fluid, are all non-metallic making the unit ideal for applications involving corrosive or aggressive liquids.

The standard configuration comprises a carbon fibre reinforced plastic can with a PTFE lining. This ensures no eddy current losses since the metallic field lines only cut across non-metallic components so no heat is generated in the magnet area and, thus, efficiency is not reduced.

Optional silicon carbide plain dry running bearings can be fitted to all QVF pumps to protect them against bearing failure in the event that there is insufficient bearing lubrication or dry running.

A simple modification to the rear bearing housing also enables the pumps to be used on dirty liquids, liquids containing solids and even slurries.

The pump range can handle fluid temperatures up to 180°C.



Centrifugal pumps

New smart pigs in the pipeline

Four US, Canadian and British organisations have formed a \$5.3 million venture to develop new ultrasonic tools for detecting stress corrosion cracking in natural gas and liquid pipelines.

Consortium members Gas Research Institute, BG Pipeline Integrity International, the Canadian Pipeline Association and PRC International plan to adapt BG's elastic wave vehicle pipeline inspection device to allow inspection of a wider range of gas transmission pipelines.

The new venture will result in two additional devices: one for 24-inch diameter pipe, able to be resized for pipes of 20 to 30 inches in diameter, and one for 24-inch diameter lines which can be resized for pipes of 32 to 48 inches in diameter. The device is currently only capable of handling 30 to 60inch diameter pipelines.

The new prototype smart pigs will be designed and built in 1997-98 with field testing scheduled to begin next year.

The devices will also incorporate two new features designed to reduce pipeline inspection costs. A gas bypass facility will allow the pig to control its speed relative to the gas stream velocity in order to optimise inspection. In-line inspection devices operate at their best when travelling at less than 10 miles per hour. However in operation, natural gas often flows through the lines at much higher speeds, propelling the smart pig along at speeds too high for optimum inspection.

The new pigs will also have the ability to negotiate tightradius pipe bends. The smaller of the two vehicles will be able to traverse tight bends with a pipe-bend radius as small as one and a half pipe diameters. Tight-radius bends are commonly found in older pipelines, such as those found in the United States with diameters less than 30 inches. It has been estimated that replacing these bends with larger-radius bends would cost the industry more than \$1 billion.

New additive technology unveiled

Paramins, a division of Exxon Chemical Company, has unveiled a new additive chemistry based on metallocene technology. The Paranox 6000 Series technology, an advanced detergent inhibitor (DI) chemistry incorporating a number of new components, will be marketed initially for passenger car motor oil (PCMO) applications.

'The new DI chemistry offers heightened potential to incorporate significant improvements in overall performance attributes and fuel economy into PCMO end-products,' states Paramins. Furthermore, the metallocene technology employs a new family of copolymers that are highly soluble and unsaturated and 'present a greater flexibility in the selection of base stocks.'

The technology is also said to enable the rapid configuration of new PCMO additive packages as industry specifications evolve.

Field trials currently underway in the United States have already logged more than one million miles.

'The advanced chemistry of this series offers the potential for a host of new options in customising finished lubricant products,' comments Sara Lefcourt, Market Manager, PCMO Products. 'It opens the door to real advantages in formulating and marketing, and ultimately may yield a strong competitive advantage for our customers.'

Accurate level measurement tank gauge

A compact servo gauge, the Model 770, capable of measuring storage tank fluid levels with an accuracy of ±0.8mm has been unveiled by Whessoe Varec.

Combined with the ability to accommodate fluid densities from 400-1200 kg/m³, and options for high pressure working, the instrument facilitates advanced inventory management solutions for the vast majority of media found in oil and gas processing, petrochemical and chemical industries.

Its versatility also simplifies instrumentation and control strategies for large installations such as tank farms and allows most or all measurement needs to be met by just one type of gauge.

The device works on the displacer principle and can be fitted with float discs capable

Going with the Flo-Pro system

M-I Drilling Fluids has published a 12-page brochure on its Flo-Pro® drill-in fluid technology. Designed to optimise completions and reservoir production during all phases of a payzone's development, Flo-Pro is a water-based, environment friendly formulation with a high degree of low shear rate viscosity of handling a range of different media. It operates in two modes: as a level only gauge or a combined level, density and water bottom gauge – transmitting data from external sensors. Standard versions work at pressures up to 6 bar, while other models can withstand pressures up to 40 bar.

Five programmable alarms are also offered in addition to conventional high and low level points.



Servo tank gauge

(LSRV), a low-to-no solids content, an extremely low friction factor for low pump pressures and a high capacity for cuttings transport.

The system is particularly suited to drilling applications that demand low-solids and high LSRV such as coiledtubing drilling, multilaterals, re-entries and workovers.

Technology News

MOL plans for the future with new refinery management system

IBM is developing a new refinery information system for MOL Hungarian Oil & Gas' Danube refinery. The system consists of a set of production management and decision support applications based on real-time and relational databases and will involve the implementation of advanced applications addressing operation planning and scheduling, refinery mass balance and vield accounting, unit data reconciliation, production data history and reporting. Interfaces will also be provided to existing distributed control systems in the refinery and to the company's existing SAP business management systems.

The open, three-tier architecture provides a flexible system that can be upgraded as required.

The new system will 'improve overall decision cycle time in operations and business management and allow MOL to be more responsive to customers and improve its global competitiveness,' states lstvan Nadasi, MOL Refinery and Logistics Business Unit Director.



Danube refinery

New gas flowmeter

A new gas flowmeter is now available from Allison Engineering of Basildon, Essex. The FlexMASSter™ features an axial flow element that provides flow accuracy to within ±1 percent of reading.

It has high repeatability and a virtually instantaneous response time. Inaccuracies caused by unpredictable or unforeseen changes in flow profiles are eliminated by a built-in tabulator turbulence conditioner.

With no moving parts and thermal flow elements consisting of all metal wetted surfaces with welded construction, the device can handle virtually any industrial gas or air measurement. Furthermore, as there are no orifices, bearings or seals to foul or fail, the meter is particularly suited for handling dirty gas.



Mass flowmeter

Transmitter measures energy flow

SteaMeter[™] is the new smart transmitter from Moore Products that combines differential pressure measurement with custom steam flow calculations to produce a output of 4-20mA mass flow or energy flow in kJ/hr and BTU/hr for saturated steam.

Differential pressure can also be output via the 4-20mA signal.

The device communicates using the HART™ protocol for re-ranging configuration and calibration.

Strategic sales and marketing system

Management Innovation Systems recently launched Petrobase, a strategic sales and marketing information system for the oil industry.

The system enables sales and marketing activities to be coordinated at a global level as well as regionally. It also provides applications for mobile sales personnel.

Facilities are included in the system for marketing, direct and indirect selling, customer services (including credit management) and account management.

A price negotiator module - an advanced quotation, competition tracking, negotiation and order entry system - provides links to Platts and Argos indices to arrive at suggested or contract-based pricing and analyses wins and while the losses, competition monitor features tracking of all prices quoted to prospects and customers on a basis, analysing daily and by region these delivery terminal.

Smart transmitter

Kuwait Petroleum GB recently became the first oil company to take the system onboard for its UK operations. It plans a worldwide roll-out at a later date.

Pleated filtering

Pall Process Filtration has launched a new Ultipleat Profile pleated filter on the UK market. The device features a crescent shaped pleat geometry which provides a 30 percent increase in effective filtration area compared to earlier designs. This, in turn, leads to improved flow rates, longer service life and cost reductions to the end user, states the company.

of all Constructed polypropylene material and featuring good gel removal capabilities, the filter is compatible with a wide range of fluids and chemicals, including viscous fluids and dispersions, leading to lower filter inventories. It is available in removal ratings from 4.5 microns to 100 microns and has a 100 percent absolute removal rating which eliminates the problems of media migration and unloading of contaminants associated with nominally rated filters.



New crescent shaped pleat geometry

PETROLEUM REVIEW MAY 1997

Technology News_

Improved project management

Project management software and services company Artemis has completed a number of enhancements to its Artemis Views client/server product suite that aim to improve interoperability among products while also improving usability and reporting capabilities.

Designed for multi-user, multiproject environments, the range enables realistic status assessments to be made based on real-time budget and resource information and is aimed at companies working to improve visibility of project status, effort, cost management and resources.

Diverless assembly system for flanges



A diverless system for assembling ANSI and API bolt flange joints has been developed by Hydra-Tight, Stolt Comex Seaway and the National Hyperbaric Centre, with support from the European Commission's THERMIE programme.

The ROV deployed tooling system, known as Atlantis, is designed to operate in water depths of up to 1,500m.

Atlantis – which is currently completing sea trials and will be ready for the market this autumn – will save up to 20 percent of the cost of conventional flange assembly methods, according to the National Hyperbaric Centre.

The system comprises two sections: a carousel preloaded with stud bolts and a bolt tensioning system. These are mounted into frames equipped with hydraulic actuators which align the tooling to the flange.

This tooling is in turn mounted in a toolskid beneath a super work class ROV along with a standard RTJ gasket. The vehicle locates the pipeline on the seabed and flies along it until the flanges are found. It then anchors itself to the pipeline astride the joint.

The Atlantis halves close around the pipe, the tooling and swivel flange aligning to the weldneck flange. The bolts are pushed out of the carousel and into the waiting tensioner which is then pressurised, simultaneously loading the bolts. Hydraulic motors then 'run down' the flange nuts to retain bolt load. Finally, residual bolt load and distribution are checked, using load washers fitted to the bolts, and adjusted if necessary.

Two computers control the whole process. The first, mounted on the ROV, is for data collection and process control, while the second, on the surface vessel, logs all recorded information and visually displays the operation's status.

Heavy duty, double helical pump

Albany Engineering has launched a new range of heavy duty, double helical pumps complying with API 676. Manufactured in Ni-resist, bronze and stainless steel, the units feature a new gear profile design which reduces both pump noise and vibration. Magnetic coupling drive is also available to eliminate product leakage or contamination.

The pumps are of modular design with many alternative pump body and gear materials, seals, couplings, electrical or liquid phase heating arrangements and drive units to suit specific duty requirements.



Heavy duty, double helical pump

The signs are suitable for

use as exit and emergency

exit signs as well as direc-

tion finding aids and route

marking. Enclosed in alu-

minium boxes, they are fire

and explosion proof and

are thus ideally suited

Alsigns has combined

within the company the

acquisition and provision of

the gas, the manufacture of

the light tubes (via its affili-

ate Surelite Ltd) and alumini-

um housings and the design.

assembly, sale and distribu-

tion of the completed signs

in a bid to keep the purchase

price to a minimum.

in hazardous

for

use

environments.

Supplying light without power

Alsigns Self-Luminous has developed a range of safety signs that use tritium as the source of illumination and require no power supply. The Permaglo signs provide an illumination of 0.51 cd/m², more than meeting current British and North American standards, the latter being only 0.21 cd/m², and are still visible at some 65-70 metres.

The tubes have a 10-year lifetime and require no maintenance or refurbishment, states the manufacturer. They can be returned for the gas to be recycled once they have reached the end of their useful life.

Contacts

Michael Smith Engineers	01483 771871
Exxon Chemical	01235 545750
BG Pipeline Integrity International	01670 713401
Whessoe Varec	01325 301100
M-I Drilling Fluids	+1 713 308 9685
IBM	+33 1 41 88 57 13
Allison Engineering	01268 526161
Moore Products	01935 706262
Management Innovation Systems	01634 814931
Pall Process Filtration	01705 302391
Artemis	01753 606060
Hydra-Tight	0121 505 0600
Stolt Comex Seaway	01224 718200
Albany Engineering	01594 842275
Alsigns Self Luminous	01784 483030

PETROLEUM REVIEW MAY 1997

Forthcoming Events

May

5th-8th

Houston: 'Offshore Technology Conference'. Details: OTC, PO Box 833868, Richardson, Texas 75083-3868, USA. Tel: +1 972 952 9494 Fax: +1 972 952 9435

6th

London: 'Sensor **Technology** Opportunities in the Upstream Oil and Gas Industry'. Details: Centre for Marine and Petroleum Technology, Exploration House, Offshore Technology Park, **Exploration Drive**, Aberdeen AB23 8GX. Tel: 01224 706600 Fax: 01224 706601

7th-8th

London: 'Marine Risk Assessment: A Better Way to Manage Your Business. Details: Fleur Heapy, The Institute of Marine Engineers, The Memorial Building, 76 Mark Lane, London EC3R 7JN. Tel: 0171 481 8493 Fax: 0171 488 1854

8th-9th

London: 'International **Conference** on the Safe Operation of **Tankers in Coastal** Waters and Approaching **Terminals**' **Details: Pauline Ashby,** The Institute of Petroleum.

12th

Houston: 'The New Competition – Moving New Gas Supply to North American Markets'. Details: North American **Gas Strategies** Conference, Suite 925, 1990 Post Oak Blvd, Houston, Texas 77056, USA. Tel: +1 403 234 4284

12th-16th

Oxford: 'Energy Economics and Policies'. Details: The College of Petroleum and Energy Studies, New Inn Hall Street, Oxford OX1 2QD. Tel: 01865 250521 Fax: 01865 791474

13th-14th

St Petersburg, Russia: '4th Annual Central/East European Gas Conference: The Return to Expansion'. **Details: Overview Gas** Conferences, 82 Rivington Street, London EC2A 3AY. Tel: 0171 613 0087 Fax: 0171 613 0094

13th-15th

Szczecin, Poland: '2nd International Conference on Marine Technology'. Details: Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA. Tel: 01703 293223 Fax: 01703 292853

14th-15th

London: 'European Conference on Leak Prevention for Onshore and Offshore Pipelines'. Details: Institution of Chemical Engineers, 165-189 Railway Terrace, Rugby CV21 3HO. Tel: 01788 578214 Fax: 01788 577182

14th-15th

London: 'Capacity, Pricing and Margins in European Oil Refining III'. Details: SMi, 1 New Concordia Wharf, Mill Street, London SE1 2BB. Tel: 0171 252 2222 Fax: 0171 252 2272

15th-16th

Vienna: 'Opportunities for the Market Integration of Road Transport in Europe - The Challenge of EU Membership'. Details: AISO, Wiednir-hauptstrasse, 631045 Vienna, Austria Tel: +43 1 501 05 3176 Fax: +43 1 502 06 283

15th-16th

Oslo: '9th European Gas Conference'. Details: Brent Dahl, Norwegian Petroleum Society/NPE, Teknostallen, Prof Brochs gt 6, 7030 Trondheim, Norway. Tel: +47 73 54 03 26 Fax: +47 73 94 55 10

19th

London: 'Response Management Systems. Details: Oil Spill Response Ltd, 1 Great Cumberland Place, London W1H 7AL Tel: 0171 724 0102 Fax: 0171 724 0103

19th-20th

London: 'The North Sea Conference 1997'. **Details: The Conference** Division, LLP Ltd, 69-77 Paul Street, London EC2A 4LQ Tel: 0171 553 1438 Fax: 0171 553 1111

19th-21st

Oxford: 'The Energy Industries and the Environmental Challenge'. Details: The College of Petroleum and Energy Studies, New Inn Hall Street, Oxford OX1 2QD. Tel: 01865 250521 Fax: 01865 791474

19th-23rd

Oxford: 'International Oil Price Risk Management'. Details: The College of Petroleum and Energy Studies, New Inn Hall Street, Oxford OX1 2QD. Tel: 01865 250521 Fax: 01865 791474

21 st

Sunbury on Thames, Middlesex:

'Petroanalysis '97'. Details: Dr R Narayanaswamy, DIAS, UMIST, PO Box 88, Manchester M60 10D Tel: 0161 200 4891/4885 Fax: 0161 200 4881/4911

21st

Leeds: 'The True Cost of Pipelines'. Details: Chartered Institution of Water and

Environmental Management, CIWEM

Events, 15 John Street, London WC1N 2EB. Tel: 0171 831 3110 Fax: 0171 405 4967

21st-22nd

Aberdeen: 'Risk Based and Limit State Design and Operation of Pipelines'. Details: IBC UK Conferences Ltd, Bookings Department, 57-61 Mortimer Street, London W1N 8JX. Tel: 0171 637 4383 Fax: 0171 631 3214

21st-22nd

Aberdeen: 'Concrete: A Feasible Option for Offshore Construction'. **Details: IBC UK Conferences** Ltd, Bookings Department, 57-61 Mortimer Street, London W1N 8JX. Tel: 0171 637 4383 Fax: 0171 631 3214

21st-23rd

Tashkent, Uzbekistan: '1st Uzbekistan International Oil and Gas **Exhibition and Projects** Conference'. Details: International Trade & Exhibitions Group, Byron House, 112A Shirland Road, London W9 2EQ. Tel: 0171 286 9720 Fax: 0171 286 0177

25th-30th

Honolulu, Hawaii: '7th International Offshore and Polar Engineering Conference'. Details: ISOPE, PO Box 1107, Golden, Colorado 80402-1107, USA. Tel: +1 303 420 8114 Fax: +1 303 420 3760

26th-28th Athens: 'Intertanko Athens Tanker Event'. Details: Intertanko, PO Box 2829 Solli, N-0204 Oslo, Norway. Tel: +47 22 12 26 52 Fax: +47 22 12 26 41

27th-29th

Amsterdam: 'Sustainable Energy Trade Fair'. Details: Amsterdam RAI, PO Box 77777, NL-1070 MS

Forthcoming Events

Amsterdam. Tel: +31 20 549 12 12 Fax: +31 20 644 50 59

28th-29th

London: '3rd International Conference on Tanker Demurrage'. Details: Judith McKay, ASDEM Ltd, Colette House, 52-55 Piccadilly, London W1V 9AA. Tel: 0171 493 0973 Fax: 0171 499 5270

29th-30th

London: 'Implementing Effective Offshore IT and Communications Infrastructre and Strategies to Maximise Profitability and Enhance Bottom-line Benefits'. Details: ICM Markteting Ltd, 5 Cavendish Square, London W1M 0BX. Tel: 0171 436 5735 Fax: 0171 436 5741

29th-30th

London: '2nd International Gas Transportation, Pricing and Accessibility Conference'. Details: AIC Conferences Ltd, 2nd Floor, 100 Hatton Garden, London EC1N 8NX. Tel: 0171 242 2324 Fax: 0171 242 2320

29th-30th

London: 'Offshore Construction and Alliancing Contracts'. Details: IBC UK Conferences Ltd, Bookings Department, 57-61 Mortimer Street, London W1N 8JX. Tel: 0171 637 4383 Fax: 0171 631 3214

29th-30th

Oslo: 'Production Separation Systems Forum'. Details: IBC UK Conferences Ltd, Bookings Department, 57-61 Mortimer Street, London, W1N 8JX. Tel: 0171 453 2733 Fax: 0171 631 3214

June

2nd-5th Orlando, Florida: 'ASME Turbo Expo '97 – Land, Sea and Air'. Details: ASME International, PO Box 422029, Atlanta, GA 30342, USA. Tel: +1 404 847 0072 Fax: +1 404 847 0151

3rd-4th

Birmingham: 'International Seminar on Equipping the Forecourt – Opportunities in Central Europe' and 'International Conference on Revolution on the Forecourt – or just Evolution?' Details: Pauline Ashby, The Institute of Petroleum.

5th

London: 'Remediation of Contaminated Land and Sediments'. Details: Society of Chemical Industry, 14/15 Belgrave Square, London SW1X 8PS. Tel: 0171 235 3681 Fax: 0171 235 7743

9th-13th

Aberdeen: 'Oil Spill Management'. Details: Oil Spill Response Ltd, Lower William Street, Southampton SO14 5QE. Tel: 01703 331551 Fax: 01703 331972

11th-12th

Bath: 'Combustion and Emissions Control'. Details: Louise Collins, The Institute of Energy, 18 Devonshire Street, London W1N 2AU. Tel: 0171 580 0008 Fax: 0171 580 4420

12th-13th

Rueil-Malmaison, France: 'Oil Markets Over the Next Two Decades'. Details: Babs Howd, DRI/McGraw-Hill, Wimbledon Bridge House, 1 Hartfield Road, Wimbledon, London SW19 3RU. Tel: 0181 543 1234 Fax: 0181 545 6248 16th-17th

Aberdeen: 'Improving Drilling Efficiency'. Details: ICM Markteting Ltd, 5 Cavendish Square, London W1M 0BX. Tel: 0171 436 5735 Fax: 0171 436 5741

16th-20th

Singapore: 'Improved Bulk Liquid Measurement'. Details: Abacus International, 214 Inchbonnie Road, South Woodham Ferrers, Essex CM3 5WU. Tel: 01245 328340 Fax: 01245 323429

17th-18th

Houston: 'Gas Pipeline Capacity '97'. Details: AIC Conferences Inc., 50 Broad Street, 19th Floor, New York, NY 10004, USA. Tel: +1 212 952 1899 Fax: +1 212 248 7374

17th-19th

Mauritius: 'Sub-Saharan Oil and Minerals'. Details: Europe Energy Environment Ltd, Roxburgh House, 24 Third Avenue, Parktown North, Johannesburg, South Africa. Tel: +27 11 442 3230 Fax: +27 11 442 4198

18th-20th 'Oil Industry Operations Course'. Details: Pauline Ashby, The Institute of Petroleum

18th-20th

Cannes: 'Multiphase '97: How deep? How far? How soon?' Details: Catherine Cox, British Hydromechanics Research Group Ltd, The Fluid Engineering Centre, Cranfield, Bedfordshire MK43 0AJ. Tel: 01234 750422 Fax: 01234 750074

19th-20th

Portugal: '1997 European Oil Refining Conference and Exhibition'. Details: Edward Bradfield, WEFA Energy, Mappin House, Winsley Street, London W1N 7AR. Tel: 0171 631 0757 Fax: 0171 631 0754

23rd-25th

'Petroleum Economics Course'. Details: Pauline Ashby, The Institute of Petroleum

24th-25th

Houston: 'Knowledge Management in the Oil and Gas Industry'. Details: Alex Daniels, First Conferences, 85 Clerkenwell Road, London EC1R 5AR. Tel: 0171 404 7722 Fax: 0171 404 7733

24th-11th July Rueil-Malmaison.

France: 'Petroleum Managment – Executive Session'. Details: R A Baker, IFP/ENSPM, 232 avenue Napoléon Bonaparte, 92506 Rueil-Malmaison, France. Tel: +33 1 47 52 71 36 Fax: +33 1 47 52 70 66

26th-27th

Newcastle upon Tyne: 'Marine Propulsion: Turbinia and Beyond'. Details: The Institute of Marine Engineers, The Memorial Building, 76 Mark Lane, London EC3R 7JN. Tel: 0171 481 8493 Fax: 0171 488 1854

30th-3rd July

Leeds: Diesel Particulates and NO_x Emissions – Engine Emissions Measurement. Details: Jamie Strachan, Department of Fuel and Energy, University of Leeds, Leeds LS2 9JT. Tel: 0113 233 2494 Fax: 0113 233 2511

Institute News

NEW MEMBERS

Mr M Al-Mashan, Kuwait Mr J Anderson, London Mr R R Bazerghi, LMC Mr A J Beswick, Edeco Petroleum Services Limited Mr B R Bogner, Amoco Chemicals Mr D R Bramhill, Bristol Mr C D Bull, Herts Mr G Caddy, Warks Mr N Carboni, Italy Mr Y H P Choy, Singapore Ms J Cooper, Ruislip Mr R E Cowlard, Assured Movements Limited Captain Q N Cox, Portsmouth Mr P Danielsson, Sweden Professor S W Davies, University of East Anglia Mr B Doggett, Hunstanton Mr K Eastwood, Warks Mr R Edhner, SSAB Tunnplat AB Mr R W Emery, Chigwell Mr M Engall, Kent Mr C Escano, TCC Ms A Feidler, Ethyl Corporation Mr M R Flint, Swanland Dr R M Forster, Scott Pickford Group Limited Mr R E Fowler, Carshalton Miss R C Gambrell, Marketline International Mr R M Garvie, R S Safety Services Limited Mr R C Gaskin, Chatham

STUDENTS

Mr R J W Bacon, RLC School of Petroleum Mr M K Claridge, RLC School of Petroleum Llt C C Cox, RLC School of Petroleum Flt Lt A C Dant, RLC School of Petroleum Mr J Feasey, RLC School of Petroleum Mr J C Ingham, RLC School of Petroleum Mr G R Johnston, RLC School of Petroleum Mr R J McGraw, RLC School of Petroleum Captain S C V McRae, RLC School of Petroleum Miss F N Ogbo, London Mr A Randerson, RLC School of Petroleum Mr M M Robson, Cambridge Miss A P Silva, Enfield Miss M Timen, London

NEW CORPORATE MEMBERS

Svenska Petroleum Exploration UK Ltd, 2 Savoy Court, Strand, London WC2R 0EX

Representative: Mr Jan Ivar Hagen

Svenska Petroleum Exploration UK Ltd is an upstream oil and gas company with interests in exploration and production in the United Kingdom and worldwide.

Fire Service College, Moreton-in-Marsh, Glos GL56 0RH Representative: Mr K Thorp

The Fire Service College is a world leader in fire emergency preparedness and occupational safety and health training. In order to support the upstream and downstream petroleum industry, the college provides a range of courses approved by OPITO, OLF or PESC. It delivers a turnkey package of training through to one-off response training for a specific need and outreach training. It also provides a full range of advisory and consultancy services. Mr P Grimson, Ministry of Defence Mr C Gurney, Promicro Limited Mr R Harper, Excel Engineering Mr T A Hedberg, SOG Energy AB Mr D L Heisler, Crawford Technical Services Mr A Indorbajevs, Recept-Holding AS Mr B Johnston, Wilde Sapte Mr A G Khalifa, Abu Dhabi National Oil Company for Distribution Mr J S Kornis, North Sea Compactors Limited Mr E Koumiotis, Liverpool Mr L MacFadyen, Circle Alliance Mr C L Malone, Monitor Company Limited Mr N J McCulloch, Ruscombe Mr D P O'Connor, Brentwood Mrs T U Okanlawon, Nigerian National Petroleum Corporation Mr D R Palmer, Slough Mrs R A Peck, Felixstowe Mr A Pill, AC Nielsen Mr S Qureshi, Stanmore Mr T F Reader, Brentwood Ms J R Smith, The Hanning Group Mr M F Smith, Reigate Mr D Smith, SGS Redwood (UK) Limited Mr M Steele, London Ms E Sun, BCG Miss E F Sweeney, New York Bagel Company Mr P Tremayne, Richard Mozley Limited Mr M S Vidler, Emirates Petroleum & Products (PVT) Limited Mr A J Walsh, ITS Testing Services (UK) Limited Mr G R E Watts, West Sussex Mr A Webster, Scunthorpe

NEW FELLOWS

Brigadier P D Foxton

Brigadier Foxton qualified as a military petroleum technical officer by successfully completing the officer's long petroleum course held at the Army School of Petroleum and on attachments to the petroleum supply and distribution industry. He is currently the Chief Executive of the Army Base Storage and Distribution Agency, with responsibility for manning the storage of tri-service material, ammunition and petroleum products.

Mr M J Battie

Mr Battie graduated from Greenwich University in 1995. He is currently the UK Technical Manager for Inspectorate Limited with responsibilities for UK laboratory developments. An active member of the Institute and the Essex Branch, he is a member of STG3, STG 3A/D and STG5.

Obituary

Members associated with the Institute's work on Petroleum Measurement will be saddened to learn of the sudden death of Alan Butcher in January.

Alan joined Wayne Tank & Pump Company (subsequently Dresser Europe) in the late 1950s and was actively involved in the design and manufacture of service station dispensers and bulk flowmeters. On leaving Dresser he worked for Gilbarco on vapour recovery systems and for the last 15 years was an independent consultant on petroleum measurement, working closely with FMA Ltd.

From his early days Alan was actively involved with various IP working groups and in particular PM-D-4 working groups on meter calibration and the use of small volume provers for the calibration of reference meters. He was a regular lecturer on the short courses at the Cranfield Institute.

Alan will be remembered for his in-depth knowledge of his subject and his positive and practical approach to his work. He will be sadly missed by his many colleagues and friends in the petroleum industry. We extend our most sincere sympathy to his wife and family.

Institute News



After 30 years the Humber Branch has made a momentous change and invited women to its Annual Dinner for the first time. Present were Amanda Spalding, Director of Development and Environment, North Lincolnshire Council, Sybil Raby and Pauline Hull, both from the South Killingholme Parish Council, who were guests at the top table hosted by Conoco. Among the total 380 who attended the dinner held in March in Grimsby were women process and mechanical engineers who work in the refineries or other local companies serving the oil industry.

Our photo shows Humber Branch Chairman John Kersey (fifth from right) with members of the Branch committee and Conoco operations manager Brian Lever (second from right). In his speech Mr Kersey said, 'In what is the Year of Engineering Success, we need to do more to spread our real success story... The Institute of Petroleum has a major role to play. It is our open university, ready to help as the huge changes in the structure of the industry demand that individuals take more responsibility for their own careers.'

If you have recently moved please can you inform The Membership Department of your new address.

AROUND THE BRANCHES

Aberdeen	
13 May:	1996 Technology Award winner
East Anglia	
15 May:	Field visit
Humber	
15 May:	Visit to Bateman Brewery
Essex	
20 May:	Visit to Gatwick Airport refuelling station
West of Scotla	and
20 May:	Environmental stewardship in Shell Expro: mathching words with action, Heinz Rothermund, Managing Director, Shell UK
London	
21 May:	AGM followed by Back to basics: LPG, David
	Hepworth, Conoco
Stanlow	
21 May:	Evening visit to Rease Heath College Farm,
	Nantwich
Edinburgh/SE	Scotland
29 May:	Annual spouses' event – visit to Tullialan Police College
Netherlands	
4 June:	Internet meeting

Copies of the 1996 Index for Petroleum Review are now available from the Library free of charge.

UK Deliveries into Consumption (tonnes)

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Products	†Feb 1996	*Feb 1997	†Jan-Feb 1996	*Jan-Feb 1997	% Change
Naphtha/LDF	229,021	142,060	496.014	315 673	-36
ATF – Kerosene	560,417	584,842	1,152,324	1.184.589	3
Petrol	1,693,045	1,711,727	3,368,829	3,428,314	2
of which unleaded	1,130,560	1,201,614	2,267,284	2,399,567	6
of which Super unleaded	62,482	45,040	126,805	86,328	-32
Premium unleaded	1,068,078	1,156,574	2,140,479	2,313,239	8
Burning Oil	418,047	373,467	789,559	810,332	3
Derv Fuel	1,129,012	1,172,138	2,232,776	2,337,644	5
Gas/Diesel Oil	797,913	632,438	1,533,362	1,467,308	-4
Fuel Oil	685,991	576,852	1,285,632	1,122,703	-13
Lubricating Oil	73,263	68,724	144,189	141,363	-2
Other Products	721,959	686,692	1,451,668	1,402,118	-3
Total above	6,308,668	5,948,940	12,454,353	12,210,044	-2
Refinery Consumption	509,524	516,743	1,082,794	1,082,385	0
Total all products	6,818,192	6,465,683	132,537,147	13,292,429	-2
† Revised with adjustments *preliminary					



PETROLEUM REVIEW

Editor

An Editor is required for *Petroleum Review*, the monthly magazine of the Institute of Petroleum.

Candidates should have eight years' experience as a working journalist, some experience of the oil and gas industry, and an adaptable writing style capable of dealing with a wide range of issues including technical subjects. The successful applicant will be able to work to deadlines using material from multiple sources (in-house and external) within tight budgets and to manage the small editorial team.

Applications, including full CV, current salary and at least two pieces of recently published material, should be sent to:

Jenny Sandrock, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR.

Closing date 12 May 1997.



THE INSTITUTE OF PETROLEUM

organised in association with the DTI

International Seminar on

'Equipping the Forecourt – Opportunities in Central Europe'

Tuesday 3 June, at the NEC, Birmingham

International Conference on

"Revolution on the Forecourt – or Just Evolution?"

Wednesday 4 June, at the NEC, Birmingham

In association with the successful 'Forecourt International' and 'Convenience Retailing Show', the IP Annual European Retail Conference and specialist half-day seminar have become a well-established forum for the discussion of current issues affecting retailing in the United Kingdom, continental Europe and the new rapidly developing markets to the East.

The theme of the 1997 conference 'Revolution on the Forecourt – or just Evolution?' reflects the tumultous changes seen in the UK retail market over the last year. The growing position of super/hypermarkets as suppliers of fuels, the consolidation of the industry, the decline in small dealer networks and the fight back by major oil companies through aggressive pricing have all featured but most significant of all, perhaps, has been the change of character of service stations with the development of combined retail sites. A number of leading participants from different sectors of the industry will examine the present state of the market.

In co-operation with the Department of Trade and Industry, an associated seminar 'Equipping the Forecourt – Opportunities in Central Europe' will be held on the afternoon of Tuesday 3 June. This seminar will enable delegates to learn more about the opportunities available to the oil industry and forecourt equipment suppliers from the potentially large markets in Central Europe and will provide a unique opportunity to meet potential customers

For a copy of the programme and registration form, please contact: Pauline Ashby, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR Tel: 0171 467 7100 Fax: 0171 255 1472



International Conference on

'The Safe Operation of Tankers in Coastal Waters and Approaching Terminals'

To be held at the Cavendish Conference Centre, London

Thursday and Friday 8-9 May

This international conference will review the lessons that have been learned from a sequence of casualties in coastal waters including the *Exxon Valdez, Braer, Borga* and *Sea Empress.* The papers, each given by a prominent specialist in his subject, will review the latest technical, operational and legal developments affecting the ability to operate large tankers safely in coastal waters.

Speakers include:

Sven Aarts (Aarts Marine), Gerry Banks (Clyde Consulting), Chris Barras (Lloyd's Register), Bob Fleming (BP Shipping), Captain Frank Goodwin (Fender Care Marine), Chris Harris and Tony Griffiths (The Coastguard Agency), Mans Jacobsson (International Oil Pollution Compensation Fund), Geert Koffeman (Smit Tak) and Captain Robert Sclater (Director of Harbours, Orkney Islands Council).

For a copy of the programme and registration form, please contact: Pauline Ashby, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR Tel: 0171 467 7100 Fax: 0171 255 1472

15th World Petroleum Congress Beijing, China 12th-16th October 1997



Within this theme, the Congress will address itself to scientific and technical subjects, economics, safety, environmental matters and managerial issues. Acknowledging recent achievements, the Congress will deal with the challenges of the next decade.

The **Plenary Addresses** by world renowned speakers will give strategic overview of developments and prospects in technical and managerial fields of interest to the industry as a whole and will include **Wang Tao**, **President of China National Petroleum Corporation**, L R Raymond, **Chairman of Board and CEO Exxon Corporation**, P H Jaffré, Chairman of Board and CEO Elf Aquitaine, Rilwanu Lukman, Secretary General of OPEC, A E Putilov, Chairman Rosneft, and K T Derr, Chairman of Board of Chevron Corporation (Dewhurst Lecture).

- The Opening Ceremony and Welcome Reception will be held in the Great Hall of the People, Beijing, the Congress and Closing Ceremony at the China World Trade Center.
- 21 forums will consider, in the context of the Congress theme, particular areas of the petroleum industry in which there are significant current activities and in which important new developments are envisaged. At each forum four or five major papers will be presented, as a basis for discussion on the platform and with the audience.
- 10 review and forecast papers will review progress and summarise state of the art technology, current research and future trends in specific areas of high interest.
- 250 posters on technical topics will lend themselves to visual presentation and individual discussion with the presenters.
- A Ministerial Panel of two hours will offer Ministers an opportunity to discuss issues of concern to them.
- A full social programme with daily sightseeing for accompanying persons; an extensive programme of site visits and post-congress tours has been arranged.
- The International Petroleum and Petrochemical Exhibition 1997 will run concurrently. Entry and transfers will be free to WPC participants.
- An additional optional 1-day programme on the Chinese petroleum sector will follow the Congress on Friday 17th October 1997.

Copies of the free technical programme, congress programme and registration form can be obtained from any WPC national committee or:

WPC-97 Secretariat, China Zhai Guangming, Secretary General PO Box 766 Liu Pu Kang Beijing 100724 China Tel: +86 10 6209 5455/5446 Fax: +86 10 6209 5447/5459 WPC Secretariat, London Paul Tempest, Director General 61 New Cavendish Street London W1M 8AR United Kingdom Tel: +44 171 467 7100/7137 Fax: +44 171 580 2230