JANUARY 1992

The Institute of Petroleum

PETROLEUM REVIEW

North Sea

Mr Colin Moynihan MP stresses that the independents will continue to play an important role in North Sea exploration

Environment

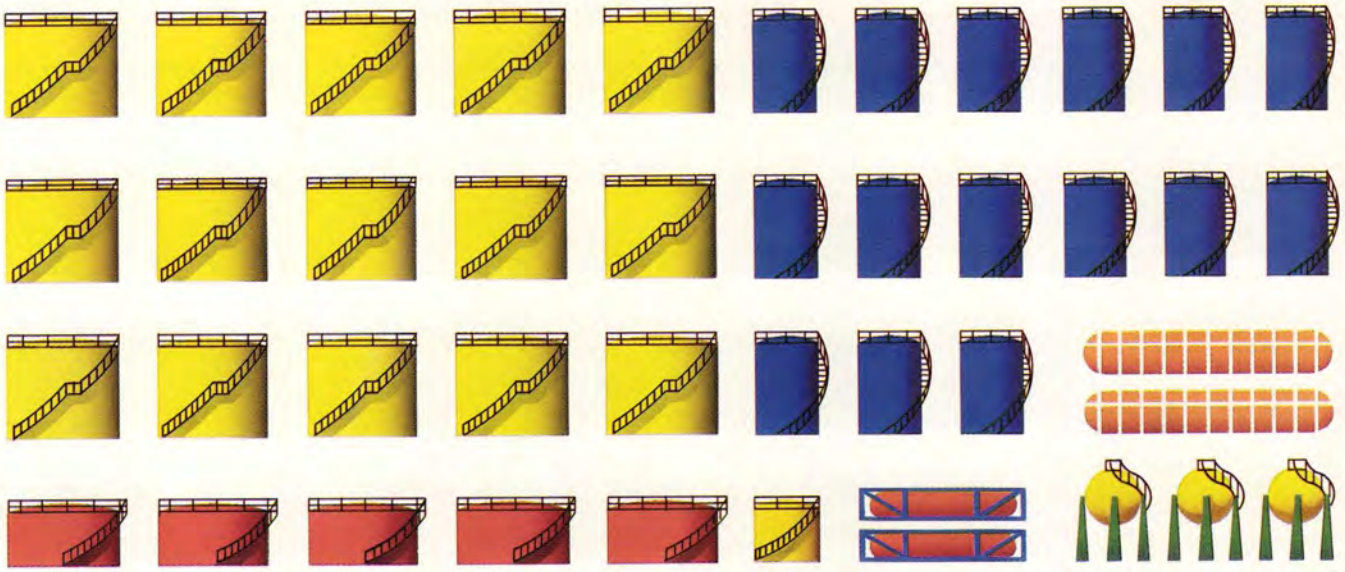
The challenges and opportunities for the petroleum industry are outlined by Lodewijk van Wachem

Peter Stief-Tauch gives details of European policies on environmental protection

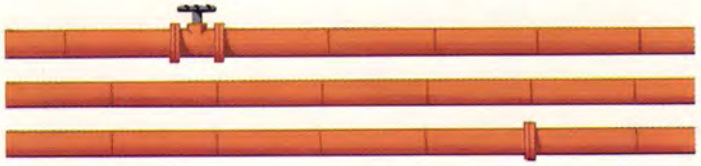
Refinery losses

Dr E R Robinson presents the findings of a detailed analysis of UK refinery losses

Simon Storage: The Full Works.

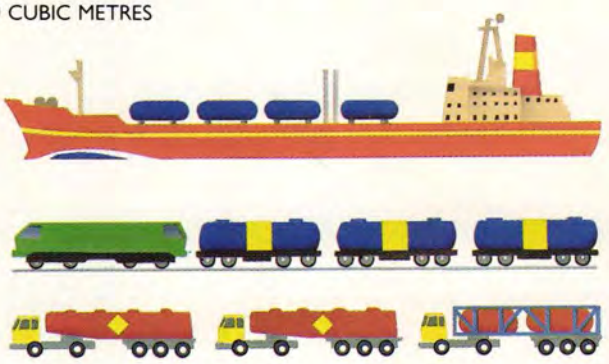


TANK CAPACITY OF 950,000 CUBIC METRES



PIPELINE NETWORKS WITH LOCAL INDUSTRIES

FULLY QUALIFIED OPERATORS & MANAGEMENT



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PETROLEUM REVIEW

January 1992 Volume 46 Number 540 £6.00

Subscription (inland) £60.00 (overseas) £75.00

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Published Monthly by
INSTITUTE OF PETROLEUM
A charitable company limited by guarantee

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London W1M 8AR
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For details of membership, including Petroleum Review at no extra cost, please apply to the Membership Department.

Printed by Eyre & Spottiswoode Ltd, London and Margate.

US MAIL: Second class postage paid at Middlesex, New Jersey.
Postmaster: send address changes to C&C Mailers International, 40 Foxhall, Middlesex, New Jersey 08846.

ABC

ISSN 0020-3076
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Contents

Cover photo of the Panuke and Cohasset jackets being delivered offshore Nova Scotia. Photo courtesy of Nova Scotia Department of Natural Resources.

. . . news in brief

9 November

The management of North Sea support helicopter operator Bristow Helicopters has completed the buyout of the company from transport group Bricom for £155m.

Chevron UK has awarded a £200,000 North Sea communications contract to Ferranti International Communications for supplying digital microwave systems for the main operational line-of-sight link between the Alba Northern platform and its associated floating storage unit.

Malaysia's national oil company Petronas has announced a preliminary agreement for a joint venture with Japan's Idemitsu Kosan and South Korea's Samsung for a 100,000 barrels per day oil refinery.

A new world record for drilling horizontal wells offshore has been claimed by Statoil with the latest producer on the Anglo Norwegian Statfjord field in the North Sea. Drilled from the Statfjord C platform, this 5,300 metre well includes a horizontal section of 2,145 metres.

12 November

Pressures for greater environmental protection and a predicted rise in energy related carbon dioxide emissions will make future energy policies more complex according to Helga Steeg, Executive Director of the International Energy Agency.

13 November

Petrol tanker drivers at Esso have accepted individual contracts which will take earnings past £30,000 for the first time in some cases.

The US Long Island-based National Response Corporation is to set up an anti-spill operation covering the Gulf of Mexico, the east and Caribbean coasts and US inland waterways.

Opec faces a possible oil price decline during 1992, according to Kuwaiti oil minister Hamoud Abdulla al-Raqba.

The Polish government is talking to 26 leading oil companies about investing in its oil industry when the industry is privatised in 1992.

20 November

North Sea Assets, the offshore oilfield services company, is to dispose of its loss-making shipping division.

A gas discovery in block 3–19a in the northern North Sea was announced by Total Oil Marine.

An agreement to cut car exhaust pollution was signed in Geneva by 19 European countries, as well as America and Canada.

Three more onshore oil and gas exploration licences were awarded by the UK government. Hillfarm Coal was given a licence covering the Strathclyde region and parts of central Scotland, Hamilton Oil for Merseyside and the Mersey Estuary and Brabant Petroleum, Canyon Resources and Yates for the Isle of Wight and Solent.

The cost of putting out the oil well fires in Kuwait is estimated at $2bn.

26 November

National Power is to invest £7.2m for a 29.85 percent stake in British independent oil and gas company, Seafield Resources.

27 November

British Petroleum is in negotiations to sell its one-third stake in two Egyptian oil concessions.

A strong rise in oil production helped Premier Consolidated Oilfields to push up taxable profits by 23 percent to £5.3m for the half year to 30 September 1991.

28 November

Atochem, the chemical unit of Elf Aquitaine, has purchased the polymerisation catalysts business of France's Rhone-Poulenc for an undisclosed price.

Drilling by Ultramar has started on the Markham field, which is the first to be developed across the UK-Netherlands median line.

29 November

LASMO has expanded its Cohasset project offshore Nova Scotia to include the development of an additional discovery in the area — the Balmoral field.

All offshore workers in the UK sector of the North Sea are to receive a personal copy of a document setting out their rights in health and safety matters, issued by the UK Offshore Operators Association, in conjunction with a number of other bodies.

3 December

South Korean shipbuilder Samsung Shipbuilding and Heavy Industries has confirmed it is to start building VLCCs shortly and will utilise its large number 2 dock facility at Koje Island for construction of tankers up to 280,000dwt.

Norway's Smedvig group is to isolate its tanker business within a separate company — the need to restructure stems from the perceived threat posed by the US Oil Pollution Act 1990. The Act opens the prospect of unlimited liability if oil pollution is caused in US waters.

Nova Corporation of Alberta has abandoned a plan to split its pipeline and chemicals businesses into two companies.

A study by independent petroleum consultant ERC has confirmed a major reserve upgrade for a Hamilton-operated UK oil prospect in Morecambe Bay.

British Petroleum has been given Energy Department approval to develop the small Donan field through *Seillean*, the company's oil production, storage and transportation vessel.

British Borneo has announced two commercial gas discoveries on blocks Main Pass 291 and Ship Shoal 176, offshore Louisiana in the Gulf of Mexico.

6 December

A 'dash for gas' is threatening the future of coal in the electricity generating market and will mean higher power charges for consumers said Mr Neil Clarke, British Coal Chairman.

BP has announced the results of an appraisal well on the Mungo field in Diapir province in the UK North Sea. Well 23/16a-52 tested at a daily average of 5,060 barrels of 40° API oil and 2.9m cu ft of gas per day on an 80/64 in choke.

Statoil has made a promising discovery just below the Arctic circle in the Nordland Two area, although no testing of the find has yet been carried out.

Japan's Nippon Oil Exploration has acquired a concession from Britain's Premier Consolidated Oilfields to explore and develop oil on a continental shelf off Myanmar.

. . . and news for Fellows

We are proud to announce the arrival of the Institute of Petroleum Fellows' ties, which are available in two designs on silk or polyester.

Full details will be mailed to all Fellows in the New Year.

For further information, please call Jackie Little on 071 636 1004.

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FROM TRADITION TO EXCELLENCE

Conservative Party energy policy

On 11 November the Hon. Colin Moynihan MP, Parliamentary Under-Secretary of State for Energy, addressed a large audience at the Institute of Petroleum on the Conservative Party's policy on energy.

He drew attention to the successful policy of privatisation under the present government — some 90 percent of the energy industry was now in private hands. This was helping to bring the benefits of competition to the consumer, whose protection was vital — the Citizen's Charter proposals were an important part of that policy.

The diversity of energy supply sources was a key factor, with increasing emphasis on natural gas. Above all, the Conservatives wanted a free market and a wide range of supply sources.

The Minister stressed the continuing activity and the record levels of capital investment in the North Sea. He said, 'A recent survey expects 1992 to be a year of very high activity'. Gas production reached a new record in 1990 and oil production was now catching up, after interruptions for safety work. He expected oil and gas production to peak in the mid-1990s. More gas was going to be used for power generation.

The share of renewable energy was likely to increase considerably, while the United Kingdom was already a leader in landfill technology as an energy source.

Mr Moynihan emphasised the importance of energy efficiency, and the present government's achievements in this respect — the Energy Efficiency Office has just been given increased funding to continue its good work.

The 1990s were set to be the decade of the environment. He hoped that guidance on these issues would come from within the industry; he did not favour a regulatory system imposed by government. He welcomed the initiatives from UKOOA and the E and P Forum earlier this year, as these gave a clear framework of guidelines on environmental issues.

He referred to the European Energy Charter, describing it as 'an ambitious, most hopeful project' which should enable the vast Soviet resources to be developed with awareness of the environmental consequences. He saw a role for the Offshore Supplies Office in identifying markets and helping supply companies to pursue contracts.

Above all, it was vital to have a partnership between government and the private sector, as opposed to the bureaucratic state control which would result if the Conservatives lost the next General Election.

Opportunities west of Shetland

Speaking at a meeting organised by the Shetland Oil Industries Group, Mr Fleming, Head of Oil and Gas at Scottish Enterprise, said that the Clair Field was likely to be developed in the late 1990s, when oil production in the North Sea starts to decline, and oil prices are expected to be higher in real terms.

He saw Clair as being the launch-pad for development activity in the West Shetland Basin into the next century.

Mr Fleming stressed the importance of new technologies — in particular horizontal drilling — in exploiting the Clair discovery and in activity west of Shetland generally.

Critical to the equation was the development of an infrastructure offshore to assist in the economics of exploiting large and technically difficult reservoirs. Horizontal drilling, for example, would help cut down expenditure through reducing the number of platforms required and this technology has advanced greatly in recent years.

The success of this year's frontier licensing round would help maintain drilling activity in Shetland waters, said Mr Fleming. However the challenges are great given that significant discoveries have been much harder to find west of Shetland, compared to the North Sea generally.

Amerada Hess wins new award

Amerada Hess Limited (AHL) has been assisted by Grampian Enterprise Ltd in becoming the first company in Scotland to achieve the 'Investors in People' quality standard.

The Aberdeen operations division of the company was rewarded for commitment to human resource development at a ceremony in London hosted by Employment Secretary, Mr Michael Howard MP.

AHL has been assisted by Grampian Enterprise Ltd in preparing their application for 'Investor in People' status, a process which has involved rigorous assessment of the company's human resource development and training procedures.

Since becoming an operator in 1983, the company has expanded rapidly in the North Sea. Training is an integral part of the company's commitment and it believes that investment in people is as essential to its future as investment in other areas of the company.

Mr Tony Ward, General Manager of Amerada Hess' Aberdeen operations commented: 'This has been a tremendous self-awareness exercise for Amerada Hess, and we are delighted to be the first company in Scotland to win accreditation.'

British Borneo in North Sea deal

British Borneo Petroleum is to buy the North Sea assets of Norsk Hydro for £57.65 million, the main part funded by a 3 for 2 share offer.

The UK interests being purchased include a working stake in 18 licences covering 21 blocks and part blocks.

The acquisition will make the company the seventh largest independent exploration and production company in Britain.

Mr Alan Gaynor, Managing Director of British Borneo Petroleum said, 'This acquisition is a rare opportunity for us to make a major advance in a single move towards our aim of becoming a significant risk-diversified independent British oil and gas company.'

Texaco Galley Prospect test

Initial test results conducted in the Galley Prospect (Block 15/23a) have been announced by Texaco North Sea (UK) Company, acting as operator for a joint venture with Elf Enterprise and Lasmo (TNS) Limited.

The well was drilled to a total depth of 13,902 feet and two intervals within the Jurassic were tested. These intervals, tested separately, yielded aggregate flowrates in excess of 17,000 barrels of 42 degree gravity oil and 28 million cubic feet of gas per day.

Mr Don Bennett, General Manager for Exploration, Texaco North Sea said, 'While these results are encouraging, further appraisal drilling will be undertaken to determine the full development potential of the block.'

First freefall lifeboats

The first freefall lifeboats to be installed in the UK sector of the North Sea have entered service on the Viking B gas production complex operated by Conoco (UK) Limited.

The Health and Safety Executive has approved the use of the two 45-seat boats, which are located on the recently-installed Viking B accommodation (BA) platform. Unlike conventional lifeboats, which are lowered into the sea by winch, the freefall craft normally drop to the surface under their own weight, although they can also be launched by gravity, using falls and a winch.

The faster method of launching speeds evacuation of platform crew in an emergency. The craft, which can also be launched in severe weather, enters the water at an angle and with a momentum that takes it safely away from the platform. Once in the sea the lifeboat is powered by a marine diesel engine. Each craft is totally enclosed with a water spray to protect it from fire and a self-contained air support system enabling the diesel engine to be run at full power while leaving the danger area.

Cambodia concession

Premier Consolidated Oilfields plc have announced that its wholly owned subsidiary Premier Oil Pacific Limited has been successful in its bid for Block IV, offshore Cambodia. A full production sharing contract will be formalised to confirm the licence award.

Premier's partners in this venture are Repsol Exploration SA, Australasian Oil Exploration Ltd and Santos Limited. Premier, as operator, will hold a 25 percent interest.

Block IV is located offshore Cambodia in the Cambodian Trough and lies directly east of the Pattani offshore gas and condensate producing region in the Gulf of Thailand.

The block is comprised of 4,775 square kilometres and has potential for large oil accumulations at Miocene and Oligocene levels.

Falkland's surveys

The Falkland Islands Legislative Council has passed a Bill which will permit licensed surveys of the Falkland Islands Continental Shelf.

Bids will be actively sought from industry to carry out a comprehensive survey of the designated areas.

Chief Executive Ronald Sampson said, 'The government is satisfied that a significant step has been taken that will enable us to identify the mineral potential of the Falklands Continental Shelf. We are preparing information for companies who may wish to operate under licence to undertake surveying work. An announcement on this and other procedures will be made in the appropriate technical and industry press, as soon as we are ready'.

Conoco discovery

Conoco (UK) Limited, as operator, have announced the results of a successful exploration well in North Sea block 29/2a, 150 miles east of Aberdeen.

Exploration well 29/2a-6, drilled by Ranger Oil on behalf of the partnership, was drilled to a total depth of 5,760 feet by the *Dan Baroness* semi-submersible rig. A second well — 29/2a-7 — will follow immediately to appraise this discovery.

Block 29/2a was awarded in the fourth round of offshore licensing. Conoco acquired operatorship in 1984 through a farm-in.

'Explorer of the Year'

The 1991 County NatWest 'Explorer of the Year' trophy has been awarded to BP, the operator of 1991's most significant find, the Cuisiana field in Colombia.

The prize was presented by Malcolm Pattinson of the 1990 winners, Hamilton Brothers, and was received by John Brown, head of exploration at BP.

Donan go-ahead

BP Exploration has been given the go ahead for development of the Donan field by the Secretary of State for Energy.

The Donan Field, north east of Aberdeen, will be developed using BP's monohull oil production vessel '*Seillean*'.

Donan lies within BP block 15/20a and is currently thought to contain about 26 million barrels of recoverable oil. Production is scheduled to start in March and is expected to reach a level of about 15,000 barrels of oil a day.

In order to prepare the original suspended discovery well, and subsequent appraisal well for production purposes, the semi-submersible drilling rig *'Sea Explorer'* is scheduled to install special subsea wellheads and control equipment.

Arafura Sea find

The Bureau of Mineral Resources (BMR) research ship *RV Rig Seismic* has discovered a huge sedimentary basin in the Arafura Sea, north of Arnhem Land in the Northern Territory.

The basin extends 50,000 square kilometres to the Indonesian border and is almost the size of the controversial Timor Gap.

BMR officials said further studies would be required to determine if the Permian and Triassic age sediments — similar to those that host the big oil and gas deposits in the North West Shelf — were prospective for hydrocarbon deposits.

One area of inquiry is the possibility that the Goulburn Graben, a sedimentary structure to the north of Darwin, could act as a potential source rock to sedimentary basins in the Arafura Sea.

Maureen discovery

Petrofina has participated in an oil discovery in a deep horizon beneath the Maureen field in Block 16/29a of the British sector of the North Sea. The test well flowed up to 12,600 barrels per day of 34° API oil on a one-inch stroke.

Is there a future for the independents in the UK North Sea?

Mr Colin Moynihan MP, Parliamentary Secretary of State for Energy giving the government's view at the above conference:

Let me begin by immediately addressing the key question which you have raised: 'Is there a future for the independents in the UK North Sea?' I believe the answer is most definitely 'yes', and that independent companies will continue to prosper and to play an important role in the North Sea exploration effort.

Let me set in context why I believe this to be so. First our objective is the optimum recovery of the economic oil and gas resources present on the UK Continental Shelf (UKCS). We provide in government the essential framework and climate that leaves as much as possible to the free market. Rather than take a direct role ourselves in planning and executing the recovery of oil and gas, we have opted to use the companies as our 'agents' in recovering our oil and gas resources. Within this the government sets the licensing, fiscal and legal framework.

The government's role in a free market is to go on providing a political and fiscal climate in which the oil and gas industry regards the UKCS as an attractive place for long-term investment. And in the national interest, we manage our oil and gas resources, taking account of safety, geological and environmental criteria. We aim to ensure that the development of the North Sea, now a mature oil and gas province, is sustained efficiently; for example, taking advantage of the extensive offshore infrastructure now in place.

The companies have responded by bringing their skills and acumen to bear on the problems of extracting oil and gas from the often hostile North Sea. And down the years, a cross-fertilisation of techniques and expertise has occurred: the oil companies' offshore activities have stimulated the development of a UK supplies industry which now exports to the rest of the world.

The central objective of our oil and gas licensing regime is perhaps rather obvious: it is that licensing must lead to the efficient and expeditious exploitation of the reserves of the UK Continental Shelf. We believe that a diversity of input, from both major and independent companies, is crucial to this and do not, therefore, discriminate between companies on the grounds of nationality or size, but assess each licensing application strictly on its merits. In this context, I believe that independents have particular strengths to contribute.

Strengths

Independent oil companies have grown from the entrepreneurial outlook of the small group of people (quite often just two or three) who started off the company. Their approach and attitude then attracts talented professionals with similar attitudes so that they have the ability to take rapid decisions as well as the opportunity to do so resulting from the confidence of their management in those decisions. This ability results in independents, with their short chain of commands, being able to integrate the views of the various disciplines and to take decisions in a very short period of time.

Another strength of the independents is their ability to run 'lean and mean'. Intrinsic in their smallness is low overhead costs without the plethora of bureaucracy, precedent, or 'the way it has always been done' attitude. As a result they pay close attention to the cost and value of every item, project, etc., and are prepared to challenge existing structures or ideas. In this way they are often more ready to examine and then grasp hold of new technology and concepts.

The independents bring into the industry new money, which would not have been invested in the oil and gas industry without them. Investors who are prepared to take a higher risk with their money, provided there is potential for a higher rate of return than is provided by the majors, have shown their eagerness to invest in the independents, thereby increasing the total 'pot' of funds available for the development of the UKCS. Independents have also proved adept and eager deal-makers — buying, swapping and farming-in into acreage.

These strengths also enable independents to supply or help to define ideas within partnerships with major companies. I believe that independents and majors have complementary roles, with independents having greater flexibility and urgency, helping to accelerate the pace of exploration in the North Sea and helping to focus attention on the development of the UK Continental Shelf.

Let me put this into practice and mention some North Sea development projects in which independents are involved. There are two fields currently under development, which will be operated by UK independents, demonstrating clearly the growing contribution which such companies are bringing to the UKCS. Lasmo's Staffa field is expected to come onstream within the

next few months and demonstrates the ingenuity which independents can bring to developing reserves which in the past would almost certainly have been considered uneconomic.

The other field, Nelson, is of a different scale and is the first field in the UKCS to involve a separation of operator responsibilities, with Shell acting as operator during the design and construction phases and Enterprise taking over when production commences in 1994. It is highly encouraging to see this type of co-operation achieved in a major development.

Overseas independents

Overseas independents such as Hamilton Brothers and Amerada Hess also contribute to the continuing success in the UKCS. Both companies have been, and remain, key players in a number of UKCS developments. I am pleased to see that both of these companies have new projects in hand — Hamilton with their gas and oil discoveries in Morecambe Bay and Amerada with their Angus oil field development which received Annex B approval recently.

On the exploration front as well, UK independents are playing an increasing role, having been responsible for drilling 17 exploration wells over the last three years, resulting in four significant discoveries, a 24 percent success ratio, comparable with the historic average in the UK sector.

Continuing success

I have explained why I believe independents will continue to make a substantial contribution to the UKCS. Let me now turn to the evidence of the continuing success of independents, which underlines my confidence on that score. First, let me remind you that in the 11th Round there was a marked increase (more than threefold) over the 10th Round in the number of independents who became operators, and that this level of success was sustained in the 12th Round.

Second, over recent years the acreage held by independents has remained broadly constant. At the beginning of 1989, UK and overseas independents together held about a third of the acreage on the UKCS; by 1991 this had changed very little.

Third, 11 of the 74 blocks awarded in the 12th Round (15 percent) were only applied for by independents (although of course independents also applied for many other blocks as well). This illustrates the point which I made earlier: that independents are willing to tackle more marginal acreage and in this sense seem to have created an area of special expertise.

Mr Colin Moyniham MP

I hope it is now clear (should anyone have doubted it) that independent companies are prospering on and contributing substantially to the UK Continental Shelf. I have every confidence that, given their strengths, they will continue to do so.

Fallow acreage

I know that the issue of fallow acreage is one of considerable interest to independent companies and that you agree with my Department that it is in the nation's interest for acreage to be explored and developed as soon as possible.

Accordingly, in the past three years, my predecessor and I have made continuing efforts to persuade companies holding fallow acreage either to drill or release this acreage. As a consequence, progress on this initiative has been very good. At the end of 1988, when this initiative commenced, 125 blocks were in the fallow category. By the end of September 1991, only 19 of these blocks remained, of which six are in 'frontier areas' to the west of the Shetlands.

Independents' eagerness for exploration acreage has been a vital stimulus in the fallow blocks initiative. Knowledge that others are keen to get at these blocks has helped produce a more positive attitude in existing licence groups, even where that acreage had been left on the shelf for years. Independents have been involved in farm-ins to fallow blocks and have brought in new ideas of exploratory plays or simply a re-assessment of what was already known.

As a result of this initiative, about 76 wells have been drilled so far. Many of the 30 blocks surrendered to date were not surrendered in time for inclusion in 12th Round. We will be looking carefully at the possibility of offering these in the next Round.

We have received proposals on how the fallow blocks initiative should be taken forward from a number of sources, including BRINDEX. We are looking at these carefully: certainly I have no intention of allowing the momentum on this initiative to be lost. This stimulus on fallow blocks has produced a similar re-awakening of interest on other blocks which had appeared to be stuck at the appraisal stage, where licensees have begun to look at new techniques of development.

This, combined with my Department's willingness to consider these new ideas and proposals, is now resulting in fields being brought forward for development, which were previously thought to be uneconomic. So the companies, their investors and the nation are set to benefit from this regeneration of interest.

I stated earlier that independents play a vital role in the development of the North Sea. Being in the market place, however, means being subject to market disciplines, such as the possibility of takeover. This means that some companies may lose their independent status. I do not believe it would be proper for the government to intervene with the workings of the market place, except in very exceptional circumstances. Were the government to intervene as a matter of course, this could well deter investors in the United Kingdom from putting money into existing and new independents in future.

Let me now turn to another issue which I know will be of interest to independents: progress on the next offshore licensing Round. We are presently reviewing the offshore licensing regime and have begun consultations on specific blocks for inclusion in the next Round. As part of this process, we are consulting all those companies which were awarded operatorships in the 12th Round, but we are of course happy to receive any suggestions from partners and those with new ideas. Although it is too soon to say exactly when the next offshore licensing Round will be announced, it is likely that the next Round will be held more or less on the usual two-yearly cycle.

New technology

We must not forget that the indepen-

dents play a vital role in helping to promote the development of new technology by the UK oil and gas industry. The United Kingdom has very substantial offshore reserves of gas and condensate. While some of these reserves can be recovered readily with current technology, others involve high pressure, deep wells and sour gas. One of the current challenges of the UKCS is the safe, economic and optimum extraction of these reserves. We are fortunate that significant infrastructure is already in place on the UKCS and while this will require substantial maintenance and refurbishment, it will provide the means to achieve the economic production of many new fields. Future development — particularly over the next 10 years — will require important advances in new technology. This will include increasing our knowledge of oil reservoirs. We will also see a new research impetus to assist in understanding the complex ways in which rocks and fluids interact in the hydrocarbon reservoirs. In areas such as exploration we will see new ways of analysing seismic data to help the industry identify hydrocarbon traps hidden in complex geological structures and also great advances are likely to be made in drilling technology.

Though most independents have little in the way of 'in-house' research facilities, they contribute, along with the majors, essential support and advice to research and development projects carried out by the supplies industry. Subsea production technology is now well established on the UKCS, but in the next few years the boundaries of what is possible with subsea systems will be extended. An overseas independent company, Hamilton Brothers, provided the opportunity for a UK joint venture company, British Offshore Engineering Technology Group, to test the first subsea separator.

UK independents have also provided opportunities for testing and demonstrating innovative new technology. In addition they sponsor research activities relevant to the offshore industry in UK universities and most, if not all, contribute to the Petroleum Science and Technology Institute. Another independent, Enterprise, is helping to finance the first project to be approved under the recently established hydrocarbons reservoir LINK scheme.

UK independents overseas

Finally, let me touch on the contribution the UK independents are making overseas. I have been monitoring closely the activities of independents overseas and am particularly encouraged by their progress. The prosperity of exploration companies depends to a large extent on their ability to obtain prime acreage and explore successfully and in this, UK companies have clearly excelled. In addition, as these independents who have developed in the United Kingdom move out to foreign countries they are increasing the sum total of expertise and knowledge which is available to industry, they expand the market for employment and services and, as they move into the development and production stage, will cause a flow of orders back to the United Kingdom.

There are many examples of independents doing well overseas. Here are but a few. Enterprise, in conjunction with the French company CEP, have recently signed two exploration agreements with the Cambodian government to explore two blocks offshore Cambodia. Also, Lasmo have just announced the successful testing of an exciting new discovery in the Natuna Sea offshore Indonesia which, I understand, has flowed very encouragingly. In addition, Premier have recently submitted a development plan for a gasfield in Pakistan and Clyde have signed a memorandum of understanding with the Yemeni authorities to begin exploration in their country.

I am delighted that UK companies are showing the necessary boldness in obtaining acreage worldwide as it becomes available to the international oil industry.

North Sea activity

As I have already mentioned, independents are certainly contributing to the continuing success of the North Sea. I would therefore like to take this opportunity to say a few words about the current outlook for the North Sea and about where I see it heading in the years to come. The development of the UK's oil and gas resources continues to be an enormous success story. Last year a record total of exploration and appraisal wells were started, some 224, beating the previous high of 190 well starts in 1984. Drilling activity was at a record level in the first quarter of 1991. The figure, as of end October, stands at 156 exploration and appraisal wells. A recent survey of company intentions carried out by my Department shows that the 1991 total is likely to be some 190 wells and in 1992, if all the company intentions indicated are realised as wells drilled, the total could be as high as 220. I believe that this exploration and appraisal survey carried out annually by my Department is a reliable indicator of changes in company confidence. This is very good news when compared with the past drilling performances, particularly as the success ratio shows no strong evidence of decreasing. Of the 96 exploratory wells drilled this year, 11 significant discoveries have been announced. The survey results are most encouraging and counter any lingering forecasts of declining confidence in the near future. It is proposed to present the results of this survey in the next edition of the Department's *Energy Trends* publication.

Impressive numbers of developments have been coming forward for approval by my Department. So far this year 17 new projects with a value of £4.2 billion have been approved and a further 19 projects worth a total of £2.7 billion are currently under consideration. Capital investment in the North Sea in the first half of 1991 was about 30 percent higher than in the first half of 1990. Early in 1991, a report by NEDO of company intentions for capital investment showed that expenditure could rise to £4.7 billion in 1991, (from £3.5 billion in 1990) and will further rise to £4.8 billion in 1992. This is good news for the oil and gas industry, for the offshore supply industry and for employment in related industries.

The high level of exploration success and development activity bodes well for the future of the UKCS. The outlook for production in the years ahead looks very encouraging indeed. North Sea oil production recovered sharply in the third quarter of last year, following extended shutdowns for safety work in the first half. 1991 production is expected to be around the level achieved during 1990 (i.e. 91.6 million tonnes). My Department's projection of the likely level of petroleum production over the next five years suggests a significant increase in production of oil and gas around 1994–95, as several new large fields come on stream. It seems possible that we will see a second peak in UK oil and gas production in the mid-decade.

It therefore looks as if the UKCS will continue to be an oil and gas province of importance well into the next century. Very good news for the UK independents and the majors.

To sum up, UK independents continue to play an ever increasingly important role on the UK Continental Shelf and I believe will continue to make a substantial contribution both at home and overseas. ■

What's new in lube oils ?

10 March 92

Lube oils are a small sector of the industry in terms of tonnage, but they represent just about the ultimate in added value potential. Their manufacture and marketing are therefore keenly competitive areas, and it is timely for the Institute to bring participants right up to date with the latest developments, through the medium of this conference.

The scene will first be set by an overview paper saying where we are now, in regard to base oil supply and demand balances and economics, and where we expect to be in the not too distant future. There will then be papers on advances in additive technology for lubricants, on commercial developments in synthetic lubricants, and the very latest technology for base oil manufacture by catalytic hydroprocessing. The important area of computerised blending and packaging is also dealt with and finally there will be an account of ongoing research into alternative base oil components. Environmental needs are apparent in the lube area, as elsewhere in the industry, and these are elaborated in the papers as appropriate.

Because of the particular interest the subject of lube oils holds for the engineering industry, this conference is being co-sponsored by the Institution of Mechanical Engineers.

Further details are available from **Miss Caroline Little,** The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Telephone: 071 636 1004. Fax: 071 255 1472.

Challenges and opportunities for the petroleum industry

By Lodewijk van Wachem, President of Royal Dutch Petroleum Company and Chairman of the committee of Managing Directors of the Royal Dutch/Shell Group

Mr van Wachem was speaking at the World Petroleum Congress, Buenos Aires in October. He said in part:

The prime challenge for the petroleum industry is to continue to meet world demand for oil and gas in a responsible fashion and to make an acceptable return on investment at the same time. So we need a good idea of how demand may evolve and what global forces and events may influence it.

Major world events often happen quickly and with little or no warning. The invasion of Kuwait and the short-lived coup in the USSR come to mind. But that does not shake my belief that having some ideas about what the future might hold is helpful, even if events turn out quite differently.

Scenario planning

I think it is fairly well known that Shell companies use scenario planning. These scenarios are not forecasts, but pictures of possible alternative futures. They are used to encourage discussion of alternatives and consideration of the 'what ifs' of business decisions. We believe they improve our view of what the world is now, and what it might be in the future. We believe they also help to prepare Shell managers to deal with the unforeseen, the event that is so unlikely that people don't think about it — until they are in the thick of handling it.

Our present global scenarios focus on three areas where change might be far-reaching — geopolitics; international economics; and the environment.

One scenario we term 'global mercantilism'. The main feature of this scenario is weakness and instability in the world's economic and political systems. Countries or regions that are frustrated with international failures focus on building a new, more managed, regional system. There is emphasis on regional pacts and bilateral agreements between trading blocs.

Although this scenario captures prevailing protectionist thinking in industrial countries, policy-makers stop short of narrowly nationalistic and inward-looking measures. They recognise the need for companies to be economically efficient and competitive. Fierce internal competition is seen as the way to produce world-class companies, and hence economic efficiency and growth. So deregulation of internal markets and the privatisation of state-owned companies are pursued. Economic policy is typified by politically-managed economic exchanges between blocs, and market-oriented exchanges within blocs.

Environmental concerns are not high on the political agenda in this picture. Local and regional problems are tackled, but there are too many international disagreements for a consensus to be reached on difficult global issues.

An alternative scenario we term 'sustainable world'. Here, economic frictions are resolved. Attention is on resolving common problems, such as taking strong action on environmental issues, particularly 'global warming'. There is consensus about how to attain economic stability, growth and co-operation between the largest economies. The dangers of failure in international trade negotiations are recognised and, with this, the importance of interdependence.

In terms of the environment, the large economic powers in particular recognise that there are limits to the burden that can be placed on the environment. There is a shift to tighter environmental regulation and taxation. There is also a global rather than a regional, focus. It is a major political challenge to help poorer countries achieve environmental improvements, given that they already face enormous pressure on their resources.

So how do we see energy in these alternative possible future worlds? In the world of global mercantilism, the energy industry faces new rules and continuous reconfiguration of markets. There is emphasis on regional self-sufficiency, which means that non-OPEC production is kept up. Building reciprocal bonds between producers and marketers is also emphasised. This, with volatile economic growth, makes it hard for OPEC to manage prices. Between cyclical over- and under-capacity, prices roller-coaster.

In sustainable world, energy is affected by environmental concerns as industry is put under more and more pressure to reduce its impact on the natural environment. These pressures include greater regulation of emissions from energy plants, 'cleaner' fuels, and improvements in energy efficiency. While the technology exists to move towards these improvements, economic and other incentives are not enough to encourage quick take-up. And even when these measures are adopted, there is inevitably a time-lag before the effect is really felt.

We assumed in the scenarios average world growth of around 3 percent a year until 2010. In view of the developments in developing countries and in the countries that we once

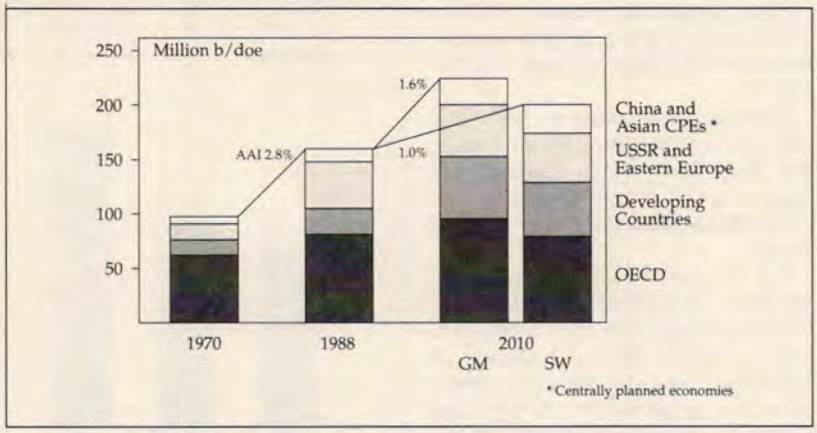

Figure 1: World primary energy demand by region

termed the centrally planned economies, this might be seen as somewhat conservative.

In global mercantilism, total world primary energy demand grows at 1.6 percent a year until 2010. That compares to 1 percent each year under sustainable world. On these assumptions and bear in mind that we are looking at trends here which can be affected by myriad pressures, world primary energy demand by 2010 could range between just over 200 to 230 million barrels a day of oil equivalent. That's an increase in the range of 20 to 35 percent over the present level of demand.

In both scenarios, the regional differences in growth are significant. For instance, by 2010, OECD demand might fall 5 percent below the current level or rise by 13 percent. But in the developing world, the growth in demand is extraordinary — possibly between 75 and 90 percent above today's demand from that part of the world. **(Figure 1.)**

Since the scenarios were prepared, we have seen the beginnings of two major developments that have potentially significant implications for economic and demand growth. First, there are signs of significant recovery in parts of the developing world, particularly in Latin America. It is entirely plausible to believe that the new commitment to market forces and financial discipline in these countries, could have a major pay-off in terms of growth in the next 20 years.

The second development is, of course, the revolution in the Soviet Union and eastern Europe. It is far too soon to say how this will evolve, particularly in the Soviet Union. Yet we can already imagine a wide range of possibilities for Soviet production, demand and net exports — or even net imports.

Environmental issues

Of course, both scenarios include our best assessment of how demand will be affected by improvements in energy efficiency and by environmental measures. I want to concentrate on a couple of points that should be kept in mind if people are to have a sense of proportion about the place of energy in the 'environmental issue'.

First is the spectacular improvement that has been made in our practical ability to measure very low amounts of pollution in air, water or soil. Twenty years ago, scientists were measuring trace contaminants in parts per million. Now we look for contaminants that may be present in parts per billion. The European Commission, for example, requires that the amount of individual pesticides in drinking water is no higher than one-tenth of a microgram per litre. Ten years ago, it was a challenge for analytical chemists to measure such a small contamination. These days, a millionth of a microgram, or one picogram, of certain pesticides can be detected in a litre of drinking water. But since, for most pesticides, one-tenth of a microgram has no toxicological significance, one picogram certainly does not.

But how many people really appreciate the relevance of terms such as picogram? Not too many, I suspect, judging by a headline I saw a while ago in a Dutch newspaper. It proclaimed a pollution level of 60 picograms in a litre in the sort of style normally reserved for disasters. It sounds horrific — until one realises that even 1000 picograms in a litre is comparable to about the length of a pencil in the distance between the earth and the sun; a single drop of oil in a very large crude oil tanker; or a fraction over two seconds in 1000 lifetimes.

Please don't misunderstand me. I am not saying that public anxiety about the environment is misplaced. But I do believe that, because today we can detect such tiny amounts of pollution, many people perceive that environmental problems have become much worse — that the world is now a much dirtier and more polluted place than in the past.

The truth is that for ordinary people going about their daily lives, the Western developed countries are now much cleaner places to live than they have been in the past. And this, despite more people and greater use of energy.

Take London as an example. In the 14th century, Carmelite monks in their monastery beside the River Thames complained that the stench of refuse and sewage in the river overwhelmed the scent of incense during their services.

A more modern example is the remarkable progress that has been made in cleaning up some forms of air pollution. In 1991 the OECD published a report about the *State of the Environment*. It comments that concentrations of sulphur dioxide in urban areas have decreased by 30 to 75 percent in OECD countries over the last 15 to 20 years.

A CONCAWE report also published in 1991, outlined the findings of a 1989 survey of western European refineries and compared them with findings from earlier surveys. The report noted that sulphur in products sold for combustion was reduced by over 60 percent between 1979 and 1989. Over the same period, sulphur dioxide emissions from oil refineries in western Europe decreased by 40 percent.

But of all countries, it is probably Japan that has pursued pollution control most vigorously through the application of technology and the introduction of stringent regulations. The result has been that emissions of sulphur oxides from oil-, coal- and LNG-fired power plants in Japan have been reduced by a factor of six between 1975 and 1988.

I am not, for a moment, suggesting that all environmental problems are perfectly under control or will be solved tomorrow. Plainly that is not the case. Nor am I suggesting that the petroleum industry, or any other energy sector for that matter, should attempt to whitewash the situation. That would serve no-one's purpose. But I do feel that not enough recognition has been given to the tremendous progress already made, and particularly in the last half century. Industry faces a communications challenge to provide accurate and balanced information about the

environment. If we fail to make our views known clearly in the right quarters, then we only have ourselves to blame if those views are misunderstood or ignored.

More than two centuries ago, Adam Smith said: 'People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices.' Given the willingness of many to suspect industry's motives, I feel there are probably still quite a few who would share his views!

Seriously, while I draw the line well before conspiracies and price-raising, I hope people of the same trade can meet for merriment and diversion. I hope they can also meet to pool their expertise and knowledge, and to organise and communicate information. In this politically complex world of ours, the voice of industry associations is a proper channel open to industry. Industry can use that voice to improve understanding of its philosophy and performance and also to enhance its contribution to solving the world's problems. If businesses make use of those associations and give them their full support, that voice will be strengthened and will, I believe, be heard.

stations. But the consequence is a loss of efficiency, so more energy is required to make the same amount of electricity.

Double-hulled tankers will give some extra protection against oil spills. But they add several thousands of tonnes of steel to the weight of a ship. Making that extra steel requires more energy.

Let us also take an everyday example, for instance, the recycling of household waste. Energy is required to collect, handle, treat and dispose of that waste. And you and I use energy when we get in our cars to drive our bottles, cans and newspapers to the recycling centre.

So it seems to me that there are many anti-pollution measures that actually result in the use of more energy. This creates a dilemma, a situation in which judgement will have to be made about where the balance of benefit lies.

Population growth

But there is one even more fundamental factor in any view of the future world environment which I haven't yet mentioned and that is population growth.

UN projections expect the number of people in the world to top 6 billion at the end of the century and reach even more than 8 billion by 2025. **(Figure 2.)**

Of the 80 million or so extra people who make up annual population growth, 95 percent are born in countries with developing economies. The biggest percentage rise will be in Africa: in 1985 there was one African country with more than 50 million people; by 2025 there will be nine.

Think for a moment just what that means. We use the term 'developing countries' to describe countries with the wholly legitimate desire to have the basic elements that make up quality of life. In the developed part of the world, we now take those basics for granted. People in the developing countries want clean water, sanitation, electrical power for light and heat, fuel for cooking. They want roads and communications. They want education and employment.

Can any of these needs be met without commercial energy? I think not.

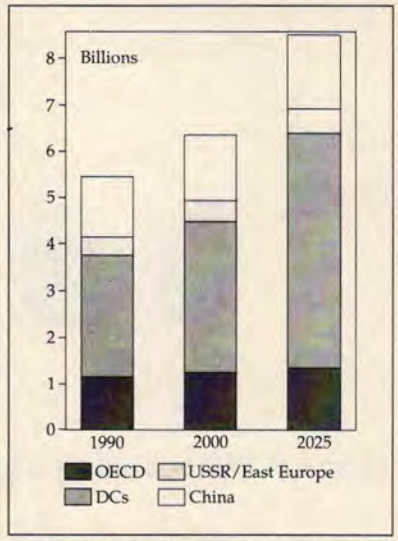

Figure 2: World population projections

The availability of reliable energy supplies at reasonable prices contributes to economic expansion. There's nothing new in that concept. In Shell, for instance, we were saying something very similar at least 30 years ago.

Furthermore, history shows that improvements to living standards lead to a slow-down in population growth. As well as economic growth, there are other important factors, such as greater literacy and education among women, and reductions in infant mortality rates. But in my view, there is simply no sensible way to avoid the need for more commercial energy in the developing world.

There seems to me to be little room for argument here. The developing countries must have the chance to improve the quality of life for their people. That means that the world as a whole will have to accept a further increase in the use of primary energy.

Global warming

And that, of course, focuses attention on the vexed question of carbon dioxide. Increased use of energy in developing countries will largely be covered by hydrocarbon fuels. That will mean more carbon dioxide will be produced each year by those countries.

A report prepared for the Intergovernmental Panel on Climate Change in 1990, suggested that the world's total gross carbon dioxide emissions from the energy sector might rise from just over an annual 5 billion tonnes of carbon in 1985, to nearly 12.5 billion tonnes a year by 2025. On average, that is an extra half a tonne of carbon each year for every single

'Technical solutions will be found to most environmental problems'

Technical solutions

But coming back again to my point about environmental issues, and looking at the lessons of history, I am optimistic. I believe that technical solutions will be found to most environmental problems. But in many cases, those solutions will involve greater use of energy. For instance, in our industry, to reduce the sulphur content of fuels and so reduce sulphur dioxide emissions, will increase the energy used by refineries to make those products. A recent CONCAWE report estimated that to remove 1 tonne of sulphur from diesel fuel would require an additional 6.5 tonnes of refinery fuel. It's a similar story for unleaded petrol where maintaining the same octane rating, or running at a lower octane without lead, demands more energy over the entire refinery—car envelope.

In yet another example, flue gas desulphurisation can reduce the sulphur oxides emitted from power

person living in the world. In 1985, 26 percent of all the carbon dioxide emissions came from the developing world — the same volume as North America generated on its own. But by 2025, the developing countries might be producing 44 percent of the carbon dioxide emissions.

The Intergovernmental Panel on Climate Change did produce a remarkable consensus on the science of global warming. But, there are still many who question it. Some argue that phenomena such as the explosion of Mount Pinatubo, the Philippine volcano, are cooling the earth's atmosphere. On the other hand, a new El Niño weather pattern in central and eastern Pacific may be warming it. The point is that it is clearly difficult to distinguish between the effects people have on the climate and the effects of natural variation.

There are also authoritative sources that are sceptical about some of the more extreme proposals to counter global warming. The recent National Academy of Sciences report *Policy Implications of Global Warming* concludes that the higher concentration of greenhouse gases since the end of the last century need not necessarily have been the main cause of the rise in global temperature in the intervening years. Yet this argument contrasts with the views of scientists involved in the Intergovernmental Panel on Climate Change and the Second World Climate Conference. So, once again, we are faced with a difficult policy dilemma.

What we can probably all agree, though, is that there's no easy or simple solution to carbon dioxide. Even so, it is prudent to take whatever measures are currently practical to ease the position.

One such measure is, of course, energy efficiency. New technologies such as gasification processes for coal and combined cycle for gas, do allow us to use some fossil fuels more 'cleanly' and more efficiently, and so reduce carbon dioxide emissions. Another contributory factor could be a switch from coal to natural gas, which was one of the major implications of the sustainable world scenario I outlined earlier. And then there is nuclear power. It does of course have the undeniable advantage of producing no carbon dioxide in power generation. Yet it comes with other environmental considerations and its unpopularity in many quarters is widely known.

But please recall my opening remarks about the level of future energy demand. There is just no question but that we will need all the world's current sources of commercial energy to meet demand now and in the near future. Of the main sources of primary energy, oil and natural gas together account for almost 60 percent of the world total. Coal makes up another 30 percent. There are sizeable amounts coming from nuclear energy and hydroelectric power and a small amount supplied by wind, solar and biomass. And this supply picture is unlikely to change much before the end of this century. So while we talk a lot about the benefits of using gas instead of oil, or oil instead of coal, the degree of freedom to choose is limited, particularly for the next 10 years.

There are some who see the use of energy being as bad for the environment as the unscrupulous factory owner who dumps toxic waste into the local river. In my opinion, that view is just not valid. I imagine all of us here accept that using energy does have an impact on the environment. It's a fact, that burning fossil fuels creates carbon dioxide. But it's not the only fact. Burning fossil fuels, or using any form of commercial energy, helps to raise living standards. And by raising living standards, we, in turn, provide the resources to make a cleaner environment. Imagine life without energy. We would revert to the world the British political philosopher Thomas Hobbes described in his *Leviathan* in which the lives of most people were 'poore, nasty, brutish and short'.

Profit motive

So what else can be done to ease the short-term problems and still move towards the new horizons of the future?

The first thing for industry to do is to continue to generate wealth. Wealth is the vital resource in efforts to solve environmental problems. To those people who still contend that the profit motive invariably runs counter to environmental aims, I simply say I totally disagree. And then I suggest they take a look at the countries of eastern Europe. There they will see that the absence of a profit motive did nothing to prevent poor environmental performance, either by governments or industry. It is probably true that no-one likes to foul his or her own nest. But not everyone has the means to avoid doing so, or to clean it up.

On the other hand, there are encouraging examples of environmental awareness and performance by governments, the public and industry to be seen in countries with open market economies such as North America, Japan and western Europe.

What does this suggest? I believe it reinforces the messages found in World Bank reports that there are certain factors that are vital to efficient economies. These factors include financial stability and incentives for high levels of savings and investment. They also include competitive open markets and governments that provide the essential infrastructure, especially education. Only growing economies can provide the resources to meet the various aspirations of people and, above all, provide jobs. Only growing economies can turn the concept of sustainable development into reality.

Quantification of UK refinery losses

By Dr E R Robinson,
Consultant to IP Refining Loss Accountability Committee

The oil industry has been concerned for many years with the financial consequences of oil loss. Standards and guides for its investigation and control in the sector of bulk cargo transfer have been produced by the industry and are being adopted as Standards by the International Standards Organisation.

More recently, industries worldwide have become increasingly conscious of the environmental impact of their activities. Although the oil industry has been active in reducing marine pollution and SO_2 atmospheric emissions, the link between the real loss of petroleum (as opposed to apparent loss due to measurement errors) and potential environmental damage has more recently become an area of heightened activity, particularly with regard to the less obvious, longer term impact of atmospheric hydrocarbon emissions on the earth's atmosphere.

This consideration was one of the reasons behind the founding in 1989 by the Institute of Petroleum of a new committee, the Refining Loss Accountability Committee, to analyse losses in the petroleum refining sector. This committee is unusual within the oil industry because all the major refiners in one country agreed to contribute their refinery loss data for independent, confidential analysis.

The general aim of the group is to achieve a clearer understanding of the factors involved in refining loss with the objective of developing measures to reduce the loss figure.

In working towards the co-operative goal of loss reduction, the group agreed a number of key definitions for the classification of losses in order that members could submit their data in a consistent and compatible format. A survey was then made of the group members' refining losses for the years 1989 and 1990. This paper summarises the findings of that survey. It reveals the overall losses and highlights the key areas within the total loss balance. The paper was presented at an IP Conference in October (see page 49).

Overall refinery balance

The group definition of refinery loss is as follows:

Loss = Total stock at end of last accounting period
plus total inputs during period
minus total outputs during period
minus total stock at end of accounting period
minus total fuel consumption

The group accepts either mass or weight as the basis of this calculation, although it also recognises the small difference between these bases. The loss percent figure is then accepted as the ratio of total loss to total inputs.

i.e. $$\text{loss \%} = \frac{\text{total loss}}{\text{total inputs}} \times 100\%$$

- **Total stock** figures include all feedstocks and products of a hydrocarbon nature.
- **Inputs** include crude oil, other feedstocks — for example, atmospheric residues, blending feedstocks and additives, imported slops and gas, including any imported hydrogen.
- **Outputs** include all products exported from site which are of a carbon or hydrogen basis.
- **Fuel** includes all oil, gas or coke which is burned within the refinery for fuel purposes. Material which is received into the refinery but is not processed, only stored prior to being transferred out, is excluded from the balance.

Using these definitions the group has established a picture of an 'average' UK refinery. This is a mix of the 11 UK member refineries within the group. During 1989/90 the loss balance for this 'average' refinery was as shown in **Table 1**.

Measurement uncertainties

Losses may be categorised as real or apparent. **Real loss** represents the actual loss of material from the refinery by, for example, flare burning, evaporative loss or spillage. **Apparent loss** is the difference in the overall balance which arises from the measurements which make up the overall balance. The **overall loss** figure is a combination of both real and apparent losses, although it is not possible to distinguish between them.

Table 1

Annual Balance
(Weight percent of inputs plus stock change)

Inputs + opening stock	%	Outputs + closing stock	%
Opening stock	7.91	Closing stock	7.89
Inputs:		**Outputs:**	
Dry crude	74.66	Measured dispatches	82.09
Process feedstocks	13.90	Feed to chemicals	3.65
Blending feedstocks	3.30	Fuel oil	1.67
Blending additives	0.02	Fuel gas	2.96
Imported slops	0·03	FCCU coke	0.94
Imported gas	0.18	Others	0.29
Stock change + inputs	**100.00**	**Total stock + outputs**	**99.49**

The annual measured loss from the 'average' UK refinery during 1989/90, based on the definitions above, was therefore:

$$\text{Loss} = \frac{100 - 99.49}{100 - 7.91} \times 100$$

$$= \textbf{0.56\% weight}$$

In addition apparent losses may be both positive and negative. It is perhaps most satisfactory to regard the overall loss as a best estimate of real loss but to recognise that this will have an associated uncertainty depending upon the quality of the measurements from which it has been derived.

Surveys of measurement systems within the group have allowed a detailed picture of the 'average' refinery to be established. This picture allows for the measurement on which the mass balance is based to be more fully defined; using this information it is possible to establish an uncertainty for the imbalance figure for the refinery.

Stock measurements

The 'average' refinery holds stocks of around 0.75 million tonnes. This is held in storage tanks as follows:

Type of tank	Total number	>50 m diam	30–50 diam	<30 m diam
Floating roof	60	10	35	15
Fixed roof	112	2	80	30
LPG	10			

These tanks have measurement systems as follows:

Level measurement	96% servo gauge	4% other type/manual
Temp measurement	75% multipoint	25% single/manual
Density	100% sampling and lab density	

Input measurements

The input quantities are calculated using the following forms of measurement:

	percent
Shore tank measurement	80
Meter	15
Ship measurement	3
Weighbridge	2

Output measurements

Output measurements are based upon the following:

	percent
Shore tank measurement	40
Meter	40
Ship measurement	5
Weighbridge	15

Fuel measurement

Fuel measurement is based upon the following:

	percent
Shore tank measurement	20
Process quality meter	70
Estimation	10

Overall loss uncertainty

Using the data above, it is possible to make a realistic estimate of the uncertainty associated with the overall refinery balance.

Each measurement will have its own associated uncertainty. This will be composed of a fixed error and a random error. For example, a flow meter fixed error would depend upon its method of calibration and the prover used for the calibration. The random error, however, is very much a function of each meter. Similarly each tank will show a fixed uncertainty, associated with its calibration, and random uncertainties from the instrumentation used to determine the mass inventory. Each tank fixed error will be unrelated to every other tank and, therefore, fixed errors will randomise over many tanks. In addition, tank transfers involve initial and final measurements when biases should cancel out. Individual ships may also show very large individual fixed errors, arising from their calibration, but these fixed errors are again randomised over many ships. For these reasons the following analysis considers only random uncertainties and determines an overall uncertainty figure for the 'average' refinery.

The starting-point of the analysis is the assessment of individual measurement uncertainties. These will depend very much on the nature of the measurement and also possibly on the sise of the parcel involved. However, reasonable estimates may be made as follows for each type of measurement:

Measurement	Mass random uncertainty %
Single tank stock	
multipoint temperature	0.3
single point temperature	0.4
Fiscal turbine/PD meter	0.3
Process flow measurement	5.0
Weighbridge	0.3
Ship measurement	1.5

Using these uncertainty figures and the breakdown of measurements within the refinery, it is possible to determine an overall uncertainty.

Overall stock uncertainty

The uncertainty associated with overall stock data will depend upon the number of tanks over which the stock is spread. Each must be weighted according to the relative proportion of stock held in that tank. Clearly the larger tanks will be more significant than the smaller. For the tanks identified in the refinery we may assume that the bulk of the stock is spread over 20 tanks and 75 percent of these ie 15, use multipoint devices whilst 25 percent or 5 use single point. This is actually rather conservative since the larger

capacity tanks are better instrumented than the smaller. The assumption leads to:

$$U_{stock} = \left[\frac{(0.75 \times 0.3)^2}{15} + \frac{(0.25 \times 0.6)^2}{5}\right]^{½}$$

$$U_{stock} = \mathbf{0.07\%}$$

Input uncertainty

Assessment of the uncertainty associated with refinery input requires not only the estimate of the percentage of total inputs which is measured by each system, but also the number of such systems. For example the number of fiscal meters, the number of shore tanks, the number of ships and the number of weighbridges, since each will tend to randomise the overall effect. The numbers which have been assumed for the 'average' refinery are:

Measurement	No of units	% of total inputs	Single unit % uncertainty
Shore tank multipoint temperature	10	80	0.3
Meter	4	15	0.3
Ship	5	3	1.5
Weighbridge	2	2	0.3

This leads to an uncertainty for the inputs as:

$$U_{inputs} = \left[\frac{(0.8 \times 0.3)^2}{10} + \frac{(0.15 \times 0.3)^2}{4} + \frac{(0.03 \times 1.5)^2}{5} + \frac{(0.02 \times 0.3)^2}{2}\right]^{½}$$

$$U_{inputs} = \mathbf{0.08\%}$$

Output uncertainties

Assessment of output uncertainty is developed in exactly the same way as for the inputs and the assumptions are:

Measurement	No of units	% of total outputs	Single unit % uncertainty
Shore tank multipoint temperature	15	40	0.3
Meter	5	40	0.3
Ship measurement	5	5	1.5
Weighbridge	2	15	0.3

This leads to an uncertainty for outputs measurement as:

$$U_{outputs} = \left[\frac{(0.4 \times 0.3)^2}{15} + \frac{(0.4 \times 0.3)^2}{5} + \frac{(0.05 \times 1.5)^2}{5} + \frac{(0.15 \times 0.3)^2}{2}\right]^{½}$$

$$U_{outputs} = \mathbf{0.08\%}$$

Fuel measurement

Fuel measurement is based upon much lower quality measurements than the inputs and outputs from the refinery, since the measurements are non-fiscal and are solely used for internal audits. Again the number of units needs to be known and these are as follows:

Measurement	No of units	% of total fuel	Single unit % uncertainty
Shore tank single point temperature	2	20	0.4
Process quality flow meter	2	70	5.0
Estimation	2	10	10.0

This leads to an overall fuel measurement uncertainty as:

$$U_{fuel} = \left[\frac{(0.2 \times 0.4)^2}{2} + \frac{(0.7 \times 5)^2}{2} + \frac{(0.1 \times 10)^2}{2}\right]^{½}$$

$$U_{fuel} = \mathbf{2.57\%}$$

Uncertainty of overall loss

The calculation of the uncertainty of the overall loss figure follows from the definition of loss percentage as:

Loss

$$\% = \frac{(\text{stock} + \text{inputs}) - (\text{stock} + \text{outputs} - \text{fuel})}{\text{inputs}} \times 100$$

Using the overall balance figures on an annual basis the following ratios may be determined.

Stock/inputs	= 7.91/(100 − 7.91)	= 0.086
Inputs/inputs		= 1
Outputs/inputs	= (82.09 + 3.65)/(100 − 7.91)	= 0.931
Fuel/inputs	=5.86/(100 −7.91)	= 0.064

Using these ratios and the overall uncertainty associated with each measurement the overall uncertainty of the annual loss figure may be calculated as:

$$U_{loss} = [(2 \times 0.086 \times 0.07)^2 + (1 \times 0.08)^2 + (0.931 \times 0.08)^2 + (0.064 \times 2.57)^2]^{½}$$

$$U_{loss} = \mathbf{0.20\%}$$

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Although fuel measurement is only a relatively minor part of the overall balance, it is clear from the figures that it is a significant factor in the overall loss uncertainty. If the fuel uncertainty were halved the overall uncertainty would fall to 0.15 percent.

Another important consideration is the uncertainty of the monthly balance. In this the significance of the stock is 12 times more significant than in the annual balance, whilst other figures also increase as the randomisation effect of fewer tanks and ships takes its effect. This leads to a monthly uncertainty of 0.25 percent. This is interesting since the monthly loss figures for the average refinery are:

Month	Loss %
January	0.88
February	0.42
March	0.34
April	0.71
May	0.51
June	0.68
July	0.32
August	0.64
September	0.62
October	0.47
November	0.60
December	0.32

Using this uncertainty it could be expected that the monthly balance would lie between a loss of 0.29 percent and a loss of 0.79 percent in 19 out of 20 months. In the above figures one out of 12 is outside this range, which strongly supports the uncertainty analysis. The average refinery annual balance may therefore be more correctly stated as 0.56 percent $\pm$ 0.20 percent at the 95 percent confidence level. The monthly balance is similarly 0.56 percent $\pm$ 0.25 percent at the same confidence level.

Breakdown of losses

The major areas in which real losses occur are the flare, various sources of evaporative loss and other sources of both vapour and liquid loss. This is indicated in **Figure 1.**

Flare loss includes all hydrocarbon burned through the flare system, whether this is pilot gas, purge gas or through the main flare line itself. Major sources of evaporative loss arise from storage tanks, from leakages within the process units and from the oil recovery system. Other vapour losses may include LPG venting or gas losses from other specific process units. Liquid losses account for a very small part of overall loss and may arise as spills or more commonly as the inseparable content of disposable sludges.

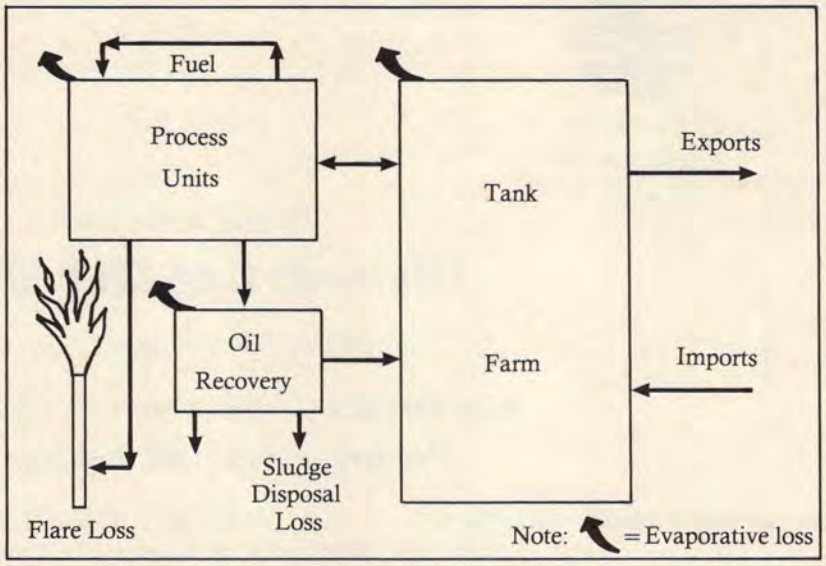


Figure 1: Refinery loss source

The approximate breakdown for the 'average' refinery has been calculated/estimated as follows:

	% of total loss
Flare loss	65
Evaporation — tankage	20
— process units	6
— oil recovery	7
Oil content of sludges	2
Total	100

The breakdown of losses is very difficult to assess, since very few of the components of the breakdown are actually measured. Most are calculated using a generalized relationship and such a method is likely to have a very high degree of uncertainty associated with it. Much of the time of the group has been spent in assessing methods used for evaluating this loss breakdown.

Flare losses

There is a close tie-up between flare loss and refinery fuel gas consumption. Most refinery fuel gas systems are tied into the flare, through a pressure control system. This means that when a refinery produces an excess of fuel gas, beyond its own requirements, this gas will find its way to the flare. Such a loss is often referred to as 'economic' flaring since the maintenance of refinery throughput is dependent upon the removal of excess gas. The avoidance of such flaring is only possible by a fundamental change in either the overall operation or the hardware of the refinery.

Measurement of flare flows is very difficult due to the very varied nature of the flow, particularly the high turndown ratio. In addition the flow needs to be established as a mass figure, so that both volume and density need to be determined. One-third of UK flare stacks have meters in the flare line. Most use a diagonal beam ultrasonic type flowmeter in which the difference between flight times, with and against the flow, gives the volume flow rate, whilst the density may be established from the actual flight time.

Those units which do not measure the flows rely upon correlations between flame height and volume flow rate. Analyses of the flare gas on an intermittent basis provide the figure for density. The uncertainty associated with such methods is probably around 50 percent whilst that of metered systems is probably within 10 percent.

Flaring is an emotive issue, since it is a very visible sign of refinery operation. To the refiner it is an obvious sign of material loss whilst to the neighbour it is a focus for concern. However, the environmental impact of flaring is far less significant than most other forms of real loss.

Evaporative losses

Evaporative losses arise principally from three sources:

- Storage tanks
- Evaporation arising from process leakage
- The oil recovery system

As with flare losses each of these aspects is very difficult to quantify. API procedures allow the calculation of losses from floating and fixed roof

tanks. These give good estimates, and represent the only feasible approach, but the uncertainty associated with the method must be of the order of 30 percent, since they are for example highly dependent on the subjective assessment of seal quality.

Process fugitive losses arise from leakages at flanges, pump seals etc. Both vapour and liquid leakages result in an evaporative loss as lighter ends are lost to atmosphere. Again these are difficult to estimate and it is necessary to rely upon limited detailed studies, with an extrapolation to other situations.

Oily water evaporative losses have again been based upon limited detailed surveys with extrapolation to other situations. Analysis of oil at the start and finish of its passage through the recovery system has shown that as much as 40 percent of the recovered oil may have been lost in the recovery process. The quantity estimated has, therefore, been based upon recovered oil quantities, with an estimate of evaporation from this.

Further work

The work of the group so far has established an overall picture of losses within UK refineries. It has also been able to establish the uncertainty associated with this loss figure. A breakdown of losses has been calculated although it is recognised that there is considerable uncertainty in these figures.

Measurement holds the key to the reliability of the overall balance. From the analysis shown above it is clear that the quality of fuel measurement within the refinery can play a major part in the overall loss. Beyond this a few possible systematic errors in measurement have been identified, which may affect the overall balance. For example some refineries have noted a movement in the datum position of the level gauge on tanks, as the level changes. The change has been observed to be repeatable and considerable in some situations. Such an error, for which no correction is applied, would represent a systematic bias in stock figures and any tank transfer figures from such a tank. The quality of measurement is to be a subject of continuous group review.

The breakdown of losses has indicated the key areas of real loss. However, flare metering still remains as a problem in many refineries and further studies are to be made.

Evaporative loss from tanks is a major problem and detailed refinements to the API procedures for the estimation of tank losses are under consideration.

The group has made considerable progress in its first year or so but recognises that substantial future work is required.

Conclusions

- A survey of 11 major UK refineries has shown that an 'average' refinery would show a loss figure around 0.56 percent of the total input quantity to the refinery.
- A survey of the measurement system within this refinery shows that this annual figure has an uncertainty around 0.20 percent.
- The uncertainty of a monthly balance on this refinery has been calculated at 0.25 percent, which is very close to the observed monthly figures for the two-year study period.
- A survey of loss areas within the refinery shows that flare loss accounts for well over half of the total loss.
- Evaporation accounts for most of the remainder. The major sources of evaporative loss are the tank farm, the oily water system and the process units. The tank farm appears to account for perhaps half of the total evaporative loss.

A number of key areas of work have been identified by the IP group and will be the subject of future studies and papers. ■

European policy on environmental protection

By Peter Stief-Tauch, Commission of the European Communities, DGXI

Our modern industrialised and highly mobile society is characterised by an ever increasing demand for energy in its various forms, in particular as fuel to generate electricity, to heat our homes and to drive the transportation systems. If no countermeasures are taken on a worldwide scale the trend will continue (Working group 3 (WG 3) of IPCC — Intergovernmental Panel on Climate Change). The result is that in 1985 the minor part of the world's population ie that of the industrialised countries, has consumed the major fraction (74 percent) of the total energy produced from fossil fuels, leaving a meagre 26 percent to the developing countries.

According to forecasts of the WG 3 the share of the developing countries is likely to increase quickly, driven above all by the rapid population growth in this part of the world. Their share may reach some 44 percent by 2025 and may in absolute numbers be greater than the total world's 1985 energy production from fossil fuels. Still, on a per capita basis, the current large discrepancies between industrialised and developing countries are likely to persist, with all the social and economic consequences for the development of the latter countries and the material well-being of their populations.

Energy production and use

This short look at the energy situation in its worldwide dimension already sets the scene for the environmental consequences of such developments. Our finite world is confronted with increasing population pressure particularly at the urban level (and this even in the industrialised countries) resulting in a strong demand for the resources required to support people's basic needs: ie arable land, water, raw materials and energy, large amounts of energy.

Without energy man is not able to produce and distribute the steadily increasing quantity of fuels and other goods, to provide for food, housing and heating. Yet producing and using energy is not without negative repercussions on the environment, particularly when being done on a large scale and without a minimum of precautions. The alarming environmental situation in the Eastern European countries is a sad confirmation of this statement. Burning of fossil fuels gives rise to pollution of air, water and soil, may endanger public health and degrade the environment beyond recovery at local, regional or even global scale.

Each type of fuel has its specific environmental problems associated with the different uses to which it is put. The fuel mix will vary from one country to the other often conditioned by the availability and cost of certain indigenous resources. Therefore the environmental consequences of fossil fuel use will differ widely, as well as the solutions being worked out to keep the negative impacts under control.

Apart from the long term aspect of resource depletion due to the steadily increasing fossil fuel consumption, one has to recognise that there exists another limiting factor which is the acceptable minimum quality of air, water and soil. In terms of health protection these quality requirements will be more or less the same irrespective of the country.

As soon as politicians recognised the urgent need for protecting public health, for maintaining an acceptable quality of the environment and for managing more carefully the limited natural resources they made the first step towards a concept known as sustainable development. This term was first coined in the 1987 report of the World Commission on Environment and Development — generally referred to as the Brundtland Report. The authors of this report (leading politicians and scientists) urged that human activity should follow a path which sustains human progress for the entire planet into the distant future. They defined sustainable development as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'.

This concept represents what in more prosaic terms is well-known to all of us as good housekeeping, with the objective to:

— maintain the overall quality of life
— maintain continuing access to natural resources
— avoid lasting environmental damage from human activities

The currently drafted Communities 5th Action Programme on the Environment will be aiming at this far-fetched and ambitious goal and may help to avoid the future degradation of our planet. In the course of the past EEC Action Programmes on the Environment and the supporting research programmes it has become evident that the actions defined therein

and carried out to a large extent were only able to bring a remedy to some urgent, more or less localised problems without really solving long term broader issues.

EEC environment policy

A better understanding of the lines of development in the Commission's thinking on environmental protection may be facilitated by a recall of the approach followed in the past and of some legal measures taken for the control of emissions into the different environmental media air, water, soil.

At the start of the Community Environment policy in late 1972, the main thrust was being directed towards curing the most urgent problems. Special emphasis was given to water pollution and waste problems. Major sources of urban air pollution (burning of gas-oil and leaded petrol, motor vehicle related emissions) were dealt with mainly under the aspect of avoiding and eliminating technical barriers to trade between Member States. Moreover, up to now a rather strict, media-oriented policy approach was followed with little concern for cross-media needs and solutions, with the exception of some more general directives on environmental impact assessment, on waste management and on nature protection.

Many legal acts suffered from the provisions in the Treaty of Rome conceived in 1957 that decisions of the Council of Ministers had to be taken by unanimity. Too often the result was a least common denominator solution and long delays in the decision-making process.

The Community action has developed along three major lines ie

a) by the setting of standards in the form of
   - — air and water quality standards and objectives
   - — source performance standards (for mobile and stationary sources discharging polluting substances)
   - — product standards
b) by monitoring the state of the environment
c) by promoting research aimed at a better understanding of the phenomena involved and development of technologies producing less pollution and less wastes.

The aspects of water pollution appear to be of minor importance to the energy industry. This does not mean that they will be neglected in developing future policy orientations. There is no doubt that discharges into the sea and inland waters of polluting substances originating from energy production and use can have very damaging effects on the environment (accidental oil spills, the criminal pollution of the Gulf, acid waters from open cast mining operations, sludges from flue gas desulphurisation (FGD) processes etc.).

Air pollution control

The field of air pollution control and its close links with energy production and use may serve as an illustration of the approaches and achievements in the past, followed by an outlook on future plans which are of importance to this industry.

The air quality standards set for SO_2 and suspended particulate matter, for lead and for NO_2 are primarily health oriented, the environmental protection is of secondary importance. Indeed, the mandatory limit values laid down are not stringent enough to protect all sensitive parts of the environment in the long run but it was the best one could achieve at the time (the early 1980s) under the legal constraint of unanimity.

Source performance standards for mobile sources were set first in the early 1970s. They took the form of emission standards for gaseous and particulate pollutants emitted from the tailpipe. As they became tighter it was necessary to act also on the composition and quality of petrol and of diesel fuel. Thus Community-wide product standards were established for both fuels and successively strengthened. Both types of standards, while procuring a certain protection of public health and the environment against the polluting emissions from these source categories and products, were conceived above all to avoid divergent national provisions which would have resulted in technical barriers to trade.

A comprehensive policy for controlling pollution would have been piecemeal without emission standards for stationary, mainly industrial sources. For certain important pollutants like SO_2, NO_x, particles and fumes or heavy metals industrial sources constitute an important if not the major part of all emissions. Power generation from fossil fuel burning is ranking in first place followed by other combustion installations and metallurgical processes. Consequently, Community provisions for such industrial premises were elaborated. To prevent and reduce air pollution, general rules concerning mandatory requirements for licensing new and substantially modified plants are laid down in directive 84/360/EC including the application of best available technology not entailing excessive costs (= BATNEEC). This concept covers both: use of process technology and of appropriate fuels. This directive requires also the retrofitting of existing plants of the categories listed in an annex, to bring them in line with BATNEEC.

For specific industrial activities, eg large combustion installations, emission standards for new plants have been laid down (SO_2, NO_x, particles) based on BATNEEC and generally available and proven at industrial scale at the time when the proposal was sent to the Council of Ministers (end of 1983). At this level the discussion took 5 years before this directive 88/609/EC was finally adopted. The reason was not so much the notion of 'not entailing excessive costs' for the emission standards, but rather the second and most important part of its provisions, the obligation to reduce within a fixed time frame the total emissions of SO_2 and NO_x from all existing plants in this category by agreed percentages compared to those of the base year 1980. The only approach capable of a consensus at that time was that of a bubble at national level, where each government could achieve its (commonly agreed) reduction obligation in an optimised way, eg by acting on the fuel mix, the early retirement of the oldest plants, the retrofitting of certain categories etc.

The setting of standards alone is not enough to guarantee their correct application and respect in the field. Monitoring and reporting of air quality, of data on emissions and of the product composition is therefore another indispensable component of Community legislation. Consequently, reference methods for monitoring of the quality standards are indicated, test methods for product composition and to a certain extent methods for emission monitoring are contained in the Community legislation together with reporting obligations. Only with the help of these references is it possible, in case of doubt, to ascertain the respect of the commonly agreed rules.

A good knowledge of the state of the environment in all its media and its evolution in space and time is required for the Commission when drafting regulations which are defendable in logic, based on facts and standing a good chance of achieving the objectives. Remember that the Commission must convince 12 governments in the Council of Ministers and the European Parliament, possibly also the industries

concerned and the public at large.

The CORINE-programme (Coordination of Information on the Environment) was started in 1986, as a Community effort to acquire relevant environmental data throughout the Member States and to present the results in a comprehensive, easily understandable form. A particular effort has been dedicated to the assessment of emissions of the most important air and water pollutants following an agreed scheme of source classification (using the OECD work) and which is being updated at regular intervals. Moreover, in June 1990 the Council adopted the important directive 90/313/EEC on public access to environmental information which will further the transparency of knowledge on the state of the environment within the Community.

The new challenges

In the course of the current 4th Action programme, emphasis was shifted towards preventing rather than curing environmental damage. This can only be achieved while properly integrating environmental concerns into the other policies, at all levels: Community, national and local.

This will require continued efforts in the field of research and development. Indeed the extensive research carried out during the last 15 years within and outside the EEC, partly in the frame of the COST programmes, revealed the full extent of the complicated interactions between the cocktail of pollutants in air or water and living ecosystems. The scientific conclusions one can draw today indicate a clear need for much tougher quality standards and objectives (air, water and soil) than the guide values for air or some of the early water quality objectives if policy measures are aiming at an effective protection of sensitive ecosystems.

A new receptor-oriented approach is currently being forwarded by the international scientific community known as the critical load concept. Such a concept appears well suited for a future EC environment policy aiming at sustainable development although its implementation is likely to cause many problems and will require difficult political choices, not least on the extent of protection which the national economies can afford to pay. Also, as knowledge improves, we will need to revise from time to time the critical loads expressed as quality objectives and standards for the different media. To ensure conformity to these objectives and standards will require tighter control of the emissions of relevant polluting substances encompassing all major point and diffuse sources. For economic and technical reasons a stepwise targeted approach may be necessary.

Also at the level of the United Nations Economic Commission for Europe in Geneva this new approach will serve as the basis for developing further the three protocols (on SO_2, NO_x and VOC) to the 1979 Convention to which the Community is party on long-range transboundary air pollution, together with all its Member States.

In the light of steadily increasing environmental damage from the acidification of precipitation encountered since the late 70's in Central, Eastern and Northern European countries (but also in wide parts of the North American continent), it became evident that only a substantial reduction at continental scale of acidifying emissions may halt this phenomenon. The Geneva convention has been established for this purpose and two of the attached protocols (on SO_2 and NO_x) are important steps towards this goal as they oblige the contracting parties to make the required efforts on emission control. Measures in hand are contained as obligations in the protocols, ie application of BATNEEC for new stationary and mobile sources, retrofitting of important existing stationary sources, availability of unleaded petrol, monitoring of emissions and depositions, development and research, exchange of and access to efficient abatement technologies.

The latest and probably biggest challenge is the greenhouse effect on climate. A change in the balance of important trace gases in the atmosphere appears likely to disturb the future climate in an as yet not fully predictable way. This change is partly attributed to human activities, above all to the increasing consumption of fossil energy. CO_2, CH_4, NO_x CFC's, O_3 and other gases are emitted or formed at increasing rates; they are suspected to trigger climatic changes which may severely modify our way of life and threaten basic resources of mankind (food, energy, raw materials).

For the sake of completeness I will also mention the initiatives taken at international level to protect the inland waters, coastal waters and the sea against pollution which originates, to a certain extent, from the transport of crude oil and fuels and from fuel use on land and at sea. Several regional conventions (Barcelona, Paris, Oslo, Helsinki) deal with specific aspects; the Community is either directly party or at least involved through some of its Member States. Efforts are directed towards better control of the emissions which arrive by direct discharge or indirectly (via the air) in the water bodies.

Future issues

The acid deposition issue:

The principal acidifying pollutants SO_x and NO_x have already received a lot of attention by the EC legislator, in the form of product standards for fuels, of emission standards for mobile and stationary sources and of air quality standards generally. New tighter requirements are under discussion aiming at

- — cleaner automotive fuels
- — a better control of volatile organic compounds from all major sources
- — a comprehensive control of sulphur emissions from the entire chain of liquid fuel production and use
- — a systematic application of best available techniques to new and existing sources of pollution in an integrated approach covering all environmental media.

Cleaner automotive fuels may be required in the future as a consequence of the recent Community policy efforts towards further tightening of emission standards for motor vehicles. Even more than in the past, engine manufacturers and refiners will have to work together to develop solutions which are viable from an energy, environmental and economic point of view. As example take the composition of gasoline and some of its characteristics: content of aromatic compounds, further limitation of benzene, elimination of scavengers, reformulated gasolines, addition of biofuels, vapour pressure, octane rating, lead content, etc.

The Commission will certainly monitor carefully developments under way in the United States and draw conclusions for its own policy proposals in this field.

As far as gas oil is concerned it has already been announced in the amended directive 88/77/EEC that by 1994 a specific automotive quality will be introduced with a much lower sulphur content of only 0.05 percent in weight. This will help to reduce the particulate emissions from diesel engines. Attention should be given to the suspected emission of dioxins from motor vehicles (traces of halogens may be enough, metals may have catalytic effects). Another potential source of harmful emissions is the lube oil which is always being burnt in small quantity. Its composition needs attention too, in particular the additives.

The field of fuel specifications for

aircraft has as yet received little attention. The anticipated sharp increase in the volume of air traffic may require some considerations with regard to regulating jet emissions and looking more closely into the composition of jet fuel.

The recently launched EC policy for reducing and preventing photochemical air pollution has directed attention to the need for a strong reduction of VOC emission from all sources. VOC's constitute, together with NO_x, the precursors from which tropospheric ozone is formed in the presence of sunlight. Model calculations have confirmed the feasibility of controlling the occurrence of peak ozone concentrations provided that the precursors' concentrations and their relevant emissions respectively can be decreased very substantially (in the range of 60 to 80 percent).

The recent introduction into the EC legislation (directive 91/441/EEC of 26 June 1991) of a control of evaporative emissions from gasoline-fuelled motor vehicles is another step towards reducing VOC emissions. Unburnt hydrocarbons have been limited long since but this directive adds a new substantial step in so far as the limit values set will require catalytic techniques to comply with them and most of the unburnt VOC's will be decomposed into carbon dioxide and water vapour.

Work is in hand for the control of evaporative emissions originating in the gasoline distribution chain (known as stage 1); a stage 2 directive proposal may be ready before summer 1992. The ongoing discussion on the most efficient and economic way of controlling also the evaporation losses during refuelling of the individual motor vehicles (stage 2) shows that this is a bone of contention between refiners and vehicle manufacturers. The outcome is subject to speculation and may depend in part on the efficiency of lobbying efforts from either side.

Computer model simulations based on Member States' forecasts on the evolution of their vehicle fleets and total transportation volumes, indicate that these measures are not enough to achieve by 1999 the 30 percent reduction of all man-made VOC emissions (base years 1988 to 1990) stipulated in the new VOC protocol to the Geneva convention.

Work is in hand for further draft EC legislation aiming at a control of solvent emissions and uses in different sectors (metal degreasing, automobile painting, printing inks) while other sectors are still under investigation (industrial coating of metallic and wooden surfaces, dry cleaning, glues and adhesives, composition of paints for non-industrial use).

The first proposals may be put forward this year.

The French initiative of 1989 for controlling sulphur emissions from the entire oil chain has been taken up by the Commission, a special working group is busy with analysing the problems and evaluating the possible solutions. Speculating about the potential outcome, I would guess as follows:

- gas-oil will be further limited in sulphur content to 0.2 percent later on (by October 1999) to perhaps 0.1 percent for general use; at least 25 percent of total automotive gas-oil of 0.05 percent may be required already by 1995. From October 1996 all gas-oil for automotive purposes will have 0.05 percent sulphur content.
- jet fuel will be considered as well in the frame of this comprehensive approach.
- fuel oil may be marketed at 2 levels of sulphur content; one in the range of 0.8–1 percent maximum for general use in small combustion installations <50 MW (mainly industrial ones) in order to give the operator a choice between cleaner fuel or technological measures at the equipment itself; the other one in the range of say 2–4 percent maximum for use in plants equipped with FGD or comparable sulphur abatement technologies.
- marine gas oil will need further assessment.
- residuals (bunker C and heavier) are a special problem to be examined in the wider international context for viable practicable solutions. In the light of the CO_2 issue, deep conversion and gasification of the residues may be a potential solution of some interest.
- refinery emissions are under examination. A technical note establishing BAT for this industrial sector is now available. Towards the end of the year, we intend to present draft legal provisions to the Council on the control of refinery emissions based on an integrated approach and considering also fugitive emissions.

The principle of an integrated pollution control, together with suitable provisions for monitoring compliance with the legal requirements (eg in the form of an environment audit) and procedures for the regular evaluation of specific emissions from major premises and processes will be at the core of future industrial pollution control policy. The systematic application of best available techniques, properly defined and regularly updated, to new plants of important industrial activities and retrofitting of existing plants under technically and economically practicable conditions, will be among the objectives of this policy. We will build on the directive 84/360/EEC and review in particular the water directives dealing with discharges of dangerous substances (76/464/EC, 86/280/EEC as well as the specific directives for Hg, Cd, etc).

The CO_2 issue

Another issue of long term importance is the development of a Community strategy to deal with the threat of climate change triggered by human activities.

As a political response to this problem, the International Panel on Climate Change (IPCC) was established at the level of UNEP in 1988. Its objective is to assess the problem in scientific terms, to work out and evaluate possible solutions and to prepare the ground for a worldwide strategy which would be implemented in the frame of a climate convention to be negotiated this year.

The Community adopted at a joint meeting of environment and energy ministers in October 1990 its negotiation position with the political target of stabilising at the 1990 level (750 million tons of carbon) its total CO_2 emissions by the year 2000.

Looking at the likely evolution of all greenhouse gas emissions at world scale on the basis of data from the countries participating in WG3 of the IPCC, this group predicted a much more rapid increase of these emissions than formerly expected. In the selected base scenario (base 1985), CO_2 emissions alone may increase by a factor of 2.5 by the year 2025 if no measures are taken at worldwide scale (from 5.15 billion tons of carbon to 12.4 billion t C). The emissions of other greenhouse gases are expected to increase substantially as well, although their data basis is less reliable.

The IPCC underlined the enormous efforts required at world scale if one wishes to maintain only the current status quo. As an example, the following reductions of anthropogenic emissions of the main greenhouse gases are deemed necessary for achieving a stabilisation of their current respective concentrations in the atmosphere:

CO_2 60–80 percent NO_x 70–80 percent
CH_4 15–20 percent CFC 11 + 12 70–85 percent

One conclusion is evident from these facts and findings: a stabilisation of these emissions is only a first step within a long term strategy aiming at effective reduction which will require a worldwide concerted action and effort.

Looking at the Community's share

in the world's total CO_2 emissions, it should decrease from 13 percent in 1985 to 11 percent by 2000 and to 9.5 percent by 2010, although in absolute numbers the emission will slightly increase in the base scenario of business as usual. For comparison: in 1985 the share of the USA was 25 percent, USSR 19 percent, China 10 percent, Japan 5 percent.

The main effort to achieve stabilisation of CO_2 emissions will be required from the energy sector because fossil fuel burning is the overwhelming source of CO_2. Methane is mainly emitted during the exploration of hydrocarbons, from leakages of natural gas and from coal mining.

Burning of oil is responsible for about half of the Community's CO_2 emissions, followed by solid fuels (31 percent) and gas (19 percent).

Two key areas have been identified as priority areas for efforts towards emission reduction in a detailed analysis carried out by the Commission's services: the production and use of electricity and the transport sector.

The main conclusions of my colleagues from DG XVII on the kind of policy orientations which should be adopted in general and in these two key areas in particular are as follows:
These sectors are growing and, especially in the end use, are highly decentralised with demand levels determined by individual decisions of millions of people. While engineering improvements will have some influence, the real key to the achievement of reducing CO_2 emissions lies with changing consumers' behaviour.

As to the engineered improvements, fuel switching is most readily at hand; in the electricity sector it may mean in the longer term a gradual substitution of nuclear energy (although nuclear energy has a certain yet rather limited potential to make a significant contribution to carbon emission reduction, its social and environmental acceptability remains a question), and in the shorter term a certain displacement of coal by gas which has become available in large quantities. To this end, the Council of Ministers has recently revoked the existing Council directive 75/404/EEC which limited severely the use of natural gas in power stations. Improvements in efficiency of the electricity generation processes (better thermodynamic cycles, gasification of solid fuels, combined heat and power production, etc) can add in the longer term a precious contribution.

In the transport sector there is little fuel switching potential foreseeable in this decade, so energy efficiency improvements and changes in consumer behaviour are the more likely means to achieve the targeted CO_2 emission reduction.

This latter sector is of course of prime importance to the refining industry and should be looked at more closely. The analysis concluded that the gains in energy efficiency will depend on:

- cooperation of motor manufacturers with fuel producers when designing and marketing vehicles with much lower specific energy requirements
- upgrading of fuel qualities in addition to the search for alternative fuels with lower carbon content
- local authorities in defining and implementing traffic management schemes and urban development policies
- the development of more comprehensive transport pricing policies.

Now to the key task of changing the consumer's behaviour. In its communication to the Council entitled: *A Community strategy to limit CO_2 emissions and to improve energy efficiency* of 25 September 1991, the Commission outlined a comprehensive strategy to reach the commitment of stabilising the total EEC carbon dioxide emissions by the year 2000 at the level of 1990 (750 million tons of carbon). The Council is invited to say whether they consider that this strategy should now be developed and, where necessary, translated into specific proposals. This strategy is based on:

- an intensification of non-fiscal measures
- a fiscal element involving a possible tax directed to energy saving and to a reduction of polluting sources of energy, but not involving any increase in taxation in total
- complementary national measures.

The Commission is convinced that it seems difficult to motivate economic agents to improving their energy efficiency if energy prices are too low. Moreover, some renewable energy sources in particular, which are favourable for the stabilisation objective as well as for overall environmental quality, will not be able to develop significantly if their market position is not enhanced by the internalisation of their comparative environmental advantage into their price. A new specific tax is considered to be the most appropriate means of giving a long-term price signal.

The new tax needs to be offset at national level by fiscal incentives and tax reductions for companies and individuals to promote environmental protection actions and energy efficiency schemes. The particular situation of each Member State would need to be taken into account in the final choice of solutions. Provision for temporary tax suspensions and for modification of the rate in the light of economic development and progress towards the stabilisation objective is also necessary as well as a regular and thorough assessment of the efficiency of the tax and of the implementation of the principle of revenue neutrality.

Unless the Community's main competitors take analogous measures, special treatment needs to be envisaged for those industrial sectors employing energy intensive production processes and with a large involvement in international trade (eg steel, chemicals, non-ferrous metals, cement, glass, pulp and paper). It could take the form, for example, of partial or total exemption, of application of a zero rate, of introduction of fiscal incentives, tax reductions or reductions in charges for employers.

Two types of tax can be envisaged: an energy tax applying equally to all energy sources or a CO_2 tax modulated on the basis of carbon content. Both have advantages and drawbacks, therefore the Commission considers as best option a combination of both types. In order to stimulate alternative sources of energy, the energy component will need to exclude renewables, but not large hydro electric schemes. It will also need to exclude energy sources used as raw materials, eg crude oil or coking coal.

The energy component of the proposed tax should not exceed 50 percent, the mix could be reviewed at a later stage in the light of developments. Based on different studies, there is convergence of views that a tax rate of about 60 ECU/ton oil equivalent (oe) (about 10 dollar/per barrel) may be sufficient to ensure that the overall strategy can come close to the CO_2 stabilisation target. A smooth introduction may start on 1 January 1993 at a rate of about 18 ECU/ton oe (3 dollar/bbl) with an additional 6 ECU/ton oe (1 dollar/bbl) in successive years until 2000. The precise details of the tax need to be worked out in collaboration with the Member States within the requirements imposed by the internal market, and by international obligations and while keeping in mind its objective to modify the consumer behaviour.

The Environment Ministers meeting on 1 October last year were unanimous in their appreciation of the Commission's initiative for a Community strategy, but of course this does not prejudge the final outcome of the

intense discussions which have now started.

It is against this background that the entire energy producing and consuming industry will have to reassess their future development objectives and strategies. Not only industry and commerce will be concerned but each individual citizen as well in his function as a consumer of energy and services. We will all have to adapt our behaviour if we want to stand up to the challenge but those who take the lead will also find a lot of new business opportunities. ■

Mr Stief-Tauch was speaking at the conference 'Making Cleaner Fuels in Europe' organised by the IP Energy Economics Group. The proceedings from this conference are available from the IP library.

FORTHCOMING EVENTS

January

9th

London: Conference on 'Nitrogen in Fossil Fuels and NOX Control'. Details: Nitrogen Conference Secretary, 1 Hamilton Drive, Sunningdale, Berkshire SL5 9PP. Tel: (0990) 23955.

9th-10th

London: Conference on 'International Boundaries: Political, Legal and Strategic Implications'. Details: The Conference Department, The Royal Institute of International Affairs, Chatham House, 10 St James's Square, London SW1Y 4LE. Tel: (071) 957 5700. Fax: (071) 957 5710.

14th-16th

Stuttgart, Germany: 'Tribology 2000'. Details: Technische Akademie Esslingen, Postfach 1265, D-7302 Ostfildern, Germany. Tel: (0711) 3400823. Fax: (0711) 3400843.

15th-16th

London: 'A Strategic Negotiation Course for the Oil and Gas Industry'. Details: Langham Oil Conferences Ltd, 37 Main Street, Queniborough, Leicester LE7 8DB. Tel: (0664) 424776. Fax: (0664) 424832.

16th

London: Lecture on 'The Zeepipe Pipeline Project'. Details: Mr AA Reed, The Pipeline Industries Guild, 17 Grosvenor Crescent, London SW1X 7ES. Tel: (071) 235 7938.

20th-21st

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

26th-30th

Houston, USA: Conference on 'Engineering for a Sustained Environment'. Details: Frank Demarest, ASME, 1950 Stemmons Freeway #5037C, Dallas, Texas, USA 75207. Tel: 214 756 4901. Fax: 214 746 4902.

Call for Papers

The fourth international conference 'Cadmo 92' — Computer Aided Design, Manufacture and Operation in the Marine and Offshore Industries will be held between 27 and 29 October 1992.

The aim of the conference is to show how ship designers, shipbuilders, ship operators and similarly designers, constructors and operators of offshore structures can benefit from the latest developments in computer applications.

Papers are invited on the following topics:

- ★ **Computational fluid dynamics**
- ★ **Ship hydrodynamics**
- ★ **Flow visualisation**
- ★ **Ship motions, stability and seakeeping**
- ★ **Ship structures/optimisation**
- ★ **Ship simulation**
- ★ **Ship propulsion**
- ★ **Advanced marine vehicles**
- ★ **Offshore structures — analysis and design**
- ★ **Damage tolerance problems**
- ★ **Other applications**

Abstracts of no more than 300 words should be submitted by 1 March to Sue Owen, Conference Secretariat — CADMO 92, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, Hampshire SO4 2AA.

27th-29th

New Delhi, India: International seminar on 'Emerging Trends in Offshore Technology and Safety'. Details: Dr SL Agarwal, Engineers India Limited, 11th Floor (Certification Division), 1 Bhikaiji Cama Place, New Delhi-110 066, India. Tel: 607279. Fax: 6872693.

27th-29th

Houston, USA: 'Petro-Safe 92'. Details: Petro-Safe 92, 3050 Post Oak Blvd, Suite 200, Houston, TX 77056, USA. Tel: (713) 621 9720. Fax: (713) 963 6284.

28th-29th

London: Conference on 'The New Realities in Pipeline Design, Construction and Operation'. Details: IIR Ltd, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: (071) 412 0141. Fax: (071) 412 0145.

28th-29th

London: Conference on 'Opening up the Russian Oil Industry'. Details: The Conference Department, The Royal Institute of International Affairs, Chatham House, 10 St James's Square, London SW1Y 4LE. Tel: (071) 957 5700. Fax: (071) 957 5710.

28th-29th

London: Conference on 'Energy 2000'. Details: Amanda Wright, IBC Technical Services, Gilmoora House, 57–61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

28th-31st

Malta: 'The First Mediterranean Oil & Gas Exhibition and Conference' co-sponsored by the IP. Details: Spearhead Exhibitions Ltd, Rowe House, 55–59 Fife Road, Kingston upon Thames, Surrey KT1 1TA. Tel: (081) 549 5831. Fax: (081) 541 5657.

February

3rd-6th

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

7th

Cranfield: Seminar on 'Flow Measurement Update'. Details: Short Course Administrator, Department of Fluid Engineering and Instrumentation, School of Mechanical Engineering, Cranfield Institute of Technology, Cranfield, Bedford MK43 0AL. Tel: (0234) 752766. Fax: (0234) 750728.

10th–12th

West Thurrock: Course on 'Oil and gas metering'. Details: John Fyfe, IITS (UK) Ltd, Caleb Brett Division, Wellheads Crescent, Dyce Industrial Park, Aberdeen AB2 0GA. Tel: (0284) 722324. Fax: (0284) 722894.

11th

London: Conference on 'Crisis Management for the Maritime Industry'. Details: Linda McKay, Conference Organiser, Legal Studies and Services Limited, Gilmoora House, 57–61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3124.

11th-12th

Houston, USA: Conference on 'Energy Strategies — The Quest for Markets'. Details: Cambridge Energy Research Associates, Charles Square, 20 University Road, Cambridge, MA 02138. Tel: (617) 497 6446. Fax: (617) 497 0423.

FORTHCOMING EVENTS

17th-18th
Singapore: Conference on 'Pacific Petroleum and Energy Finance and Investment Exchange'. Details: Global Pacific Enterprises Pty Ltd, 25 Kevin Avenue, Avalon, Sydney 2107, NSW, Australia. Tel: (612) 973 1912. Fax: (612) 973 1925.

17th-21st
Aberdeen: Course on 'Petroleum Exploration and Development Economics'. Details: DCA Consultants Ltd, Rosewall Cottage, Main Road, Aberuthven, Perthshire PH3 1HB. Tel: (0764) 63936.

18th
London: Lecture on 'Gas Pipelines BS8010 and Risk Assessment — A Case Study'. Details: Mr AA Reed, The Pipeline Industries Guild, 17 Grosvenor Crescent, London SW1X 7ES. Tel: (071) 235 7938.

18th-19th
Nuremburg, Germany: 'Hydrogen Energy Technology III'. Details: VDI-Gesellschaft Energietechnik, Postfach 10 11 39, W-4000 Dusseldorf 1, Germany. Tel: 49 211 6214.

Call for Papers

The third international Desulphurisation conference will be held between 22 and 23 March 1993. The conference organised by the Institution of Chemical Engineers and the Institute of Energy will concentrate on technologies and strategies for reducing sulphur dioxide emissions from large utility plant, small industrial systems and chemical plant.

Papers are invited on the following topic areas:

- ★ **Technologies and strategies for limitation of sulphur dioxide emissions both from utility and industrial scale plant**
- ★ **Alternatives to flue gas desulphurisation**
- ★ **Emission reductions from chemical plant and oil refineries**
- ★ **Costs of control techniques**
- ★ **Waste disposal**
- ★ **Novel desulphurisation techniques and future developments.**

Titles and an abstract (250 words) should be sent to IChemE Conference Section (Des III), 165–171 Railway Terrace, Rugby, Warwickshire CV21 3HQ, by 31 January.

18th
London: Seminar on 'Oil Price Information'. Details: Mrs Catherine Cosgrove, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Tel: (071) 636 1004.

20th
London: Conference on 'Doing Business Without Paper — the impact of EDI on the upstream and downstream oil industry'. Details: Susan Ashton, The Institute of Petroleum.

25th-27th
London: Course on 'Introduction to Petroleum Exploration for Non-Geologists'. Details: The Administrative Secretary, JAPEC, c/o The Geological Society, Burlington House, Piccadilly, London W1V 0JU. Tel: (071) 434 9944. Fax: (071) 439 8975.

26th-28th
Santiago, Spain: Conference on 'Deepwater and Marginal Oilfield Development'. Details: Offshore Conference Services, 34–36 Apsley End Road, Shillington, Hitchin, Hertfordshire SG5 3LX. Tel: (0462) 712049. Fax: (0462) 711889.

27th-28th
London: Conference on 'Managing Energy Price Risk'. Details: IIR Limited, 28th Floor, Centre Point, 103 New Oxford Street, London WC1 1DD. Tel: (071) 379 8040. Fax: (071) 412 0143.

IP WEEK 1992

Tuesday 18 February

Seminar on 'Oil Price Information'
Special luncheon — Mr Kenneth T Derr, Chairman and Chief Executive Officer, Chevron Corporation will be the guest of honour and speaker on the topic 'Letter from America'.
Mr NJ Tilling, Paramins Group, Exxon Chemicals will talk to the IP's London Branch on the subject of 'Trends in Automotive Fuels and Lubricants'.

Wednesday 19 February

The IP Annual Dinner.

Thursday 20 February

Conference on 'Doing Business Without Paper — the impact of EDI on the upstream and downstream oil industry'.

For further details please contact **Miss Caroline Little** at the Institute of Petroleum on **(071) 636 1004.**

Energy efficiency and emissions reduction

By Mr Peter Rost MP

Scientists will continue to argue for some years yet before we reach a clear consensus about the causes of global warming. Nor will we know the likely effects on climate, sea levels and food production with any degree of certainty, perhaps for another decade. When we consider the long lead times involved in taking remedial action to reduce, or even stabilise, emissions and yet do not know by how much they may need to be reduced or how urgently, it is no wonder that decision takers feel they have to grope in the dark.

At least there is widespread agreement that a prudent insurance policy needs to be applied in the meantime, as a start. The Toronto protocol recommending the reduction of CO_2 by 20 percent from 1988 levels by 2005, is such a least cost policy, but more ambitious than the European Community decision to stabilise emissions amongst our 340 million energy users at 1990 levels by the year 2000.

Yet even this modest objective is not attainable on present policies nor at current energy prices. The incentives to motivate fuel switching, greater energy efficiency, renewables and cleaner energy technologies are simply not strong enough.

The Community contributes 13 percent to global CO_2, compared to 23 percent for the United States, 5 percent for Japan and 25 percent for Eastern Europe and USSR. So whatever we do, many argue with some justification, hardly matters, particularly when we consider the inevitable rising energy consumption expected in the developing world. An even more daunting challenge, making Europe's efforts seem almost irrelevant, is the inexorable, continuing growth in world population.

But, we should consider, the EC is now the world's largest economic entity and unless we offer leadership and example, by putting our own house in order, how may we expect to exert moral or political influence and authority over the rest of the world?

It was against this background that Brussels launched its recent bombshell proposals for energy and carbon taxes; we have the inevitable knee-jerk reaction from predictable quarters but, thankfully, cautiously supportive noises from government. After all, the Environment White Paper 'Our Common Inheritance' acknowledged the reality, that present market signals will need to be strengthened if we are to make progress in cleaning up our energy act.

Options

Let us examine the rationale of what is on the table and whether we need to be so frightened by it.

On present trends, even taking into account the energy efficiency programmes already in place, many in Community countries with stronger commitment than the United Kingdom, the estimate is that CO_2 emissions are likely to grow by another 11 percent by the year 2000.

Renewable energy sources could provide only 5 percent of energy consumption by the year 2000, replacing fossil fuels. Even this is ambitious and will require strong governmental support along the lines of the Non Fossil Fuel Obligation subsidy.

Fuel switching, from coal to cleaner and more thermally efficient combined cycle gas turbines, is going ahead and will play an important role in reducing emissions. But progress will depend upon substantially increased gas imports to the Community and a costly build-up of the European gas grid. The EC initiative to enforce the 'European Energy Charter' is therefore a crucial component, for without free competitive movement of gas across frontiers, the huge potential of increased gas from Russia cannot become accessible.

Faster application of cleaner energy technologies cannot make more than a marginal contribution in the target timescale. Despite the European 'Thermie' programme which is helping finance and disseminate research and demonstrate new technology, it is difficult to see how for instance, proven clean coal burning such as coal gasification and the fluidised bed, can progress unless heavily subsidised.

Peter Rost MP

Nor will increased nuclear power come to our rescue by the year 2000. Not only in the United Kingdom has new investment all but come to a halt; our Sizewell PWR under construction, is only likely to displace capacity which will need to be phased out from our ageing first generation Magnox reactors. Even if the environmental and safety concerns are overridden, the economics of nuclear are now handicapped because it is the only energy source which is priced at the full

environmental cost — all externals have had to be itemised as a result of the privatisation of electricity. The full fuel cycle, waste disposal and estimated decommissioning are now added to the balance sheet, making nuclear uncompetitive with fossil fuels, whose external environmental costs are not internalised.

Energy efficiency

So how is the Brussels target to be achieved? Most of it must and is able to come from improved energy efficiency. The 'Save' programme is showing the way with proposals to combine a package of stronger regulation with reinforced market signals. In the domestic and commercial sector, representing 20 percent of our energy use, we will apply energy labelling of appliances, energy auditing, higher insulation standards and promotion of more energy efficient lighting.

Industry, consuming another 20 percent of our fuel, will see a wider application of combined heat and power (CHP), as will the power generators. Raising the thermal efficiency of fuel conversion, even above the 50 percent achievable with gas turbines, to the 80 percent potential from CHP, can make by far the largest contribution to reduced emissions at no net cost, since pay-back is well within commercial investment criteria.

Transport, contributing 25 percent of the Community's CO_2 emissions and the fastest growing sector, will also be given fiscal incentives to promote the marketing of more fuel efficient and cleaner engines. Consumers have responded to the cash saving from lead-free petrol and, particularly in France, to cheaper diesel — after governments applied the fiscal carrot-and-stick. Extending this principle can provide much stronger market signals.

Energy taxes

What has been realistically grasped by the Commission is that achieving even what is cost-effective in improved energy efficiency cannot come fast enough, nor can fuel switching, combined heat and power, renewables and new technologies — without imposing higher energy taxes and incentives. Current prices are just too low. A phased-in tax on all energy except renewables, starting with $3 a barrel and rising in stages to $10 a barrel by the year 2000, is proposed, together with a more specific tax based on carbon content. Energy used as raw materials would be excluded. Energy intensive industries would be given special relief.

'Current prices are just too low'

Such a radical strategy will require careful handling. If applied fairly, sensibly and gradually, it could have a beneficial economic impact on efficiency, productivity and competitiveness. The revenue will need to be used to reduce tax burdens elsewhere and provide fiscal incentives for improved energy efficiency.

Such a tax regime will also need to be even-handed across member states; the British and German energy economies, heavily dependent on coal, must not be penalised, while France, with its high nuclear content, is at an advantage.

Many of these difficulties could be overcome if the strategy were devised, not so much as a crude tax on energy and carbon content but with more emphasis on 'the polluter pays'. Why not gear the taxes to penalise the wasteful and reward the efficient? After all, it is not the fuel itself that causes the pollution, but the degree of efficiency of its use. If coal is burned cleanly, as at the CHP fluidised bed power station at Slough, the 80 percent thermal efficiency is less polluting than a so-called clean Combined Cycle Gas Turbine which is being built at Killingholme offering only a 50 percent thermal efficiency.

A phased in tax on waste heat would offer stronger signals to power generation, to raise thermal efficiency, than EC proposals. Similarly, a carrot-and-stick tax regime, geared to the waste of energy, would penalise inefficient electrical domestic appliances, buildings, industrial processes and transport. Energy efficiency at the consumer end and in fuel conversion would be rewarded. To tax the fuel or its carbon content as the Company suggests, might result in a blunter tool than a carefully structured regime focusing on the wasteful use of the fuel.

If the objective is to motivate change we need to re-examine what is on the table. Substantial political intervention in energy markets can only be justified if we are satisfied that the best and most effective regime is applied. ■

Venezuelan fuel advances across the world

By Carol Reader

Orimulsion, the new fuel developed to exploit the huge extra heavy hydrocarbons and bitumens of the Orinoco Belt in Venezuela, is making good progress towards acceptance and extensive development. The initial research stages have long since been passed and commercial development is already under way. Now buyers are being sought in every corner of the globe for this relatively unknown product. Meanwhile, research into yet more innovative technology continues.

Originally ignored while the exploitation of the country's reserves of conventional light and medium gravity crudes took place and until technology caught up with the viscosity which caused handling and transport problems, Orimulsion has at last arrived.

Orimulsion is a trademark for the new emulsion, which is 70 percent bitumen and 30 percent water with a surfactant additive. The emulsification with water makes the product less viscous and enables it to be pumped, stored as any other lighter product and transported conventionally in standard tankers.

Its development reflects the desire and urgent need of the Venezuelans to utilise all the country's natural resources as a means of solving their severe economic problems, now somewhat better, thanks to radical reforms undertaken by President Carlos Andres Perez and his government over the last two years.

With the success of research into bitumen emulsions at Intevep, the research arm of the state-owned Petroleos de Venezuela SA, a colossal potential for generating new wealth has now been opened up. The Venezuelans believe that they should take the opportunity to exploit their discovery in case the economics of the project should change at any point in the future.

Reserves of natural bitumen are vast — in 54,000 square kilometres of the Orinoco Belt in the east of Venezuela are sufficient reserves to allow production of 1.5 million barrels per day for the next 450 years, according to a spokesman from Lagoven, one of the three PdV subsidiaries which are involved in this gigantic scheme (the others are Maraven and Corpoven). The three companies have carved up the Orinoco Belt between them and are responsible for operations as far as the coastal terminal.

However, these figures might well prove to be conservative — with continuous steam injection, recovery rates are expected to be substantially improved.

Detailed exploration in the Orinoco Belt began as recently as 1979. Since that time 662 wells have been drilled, with an 85 percent success rate, accounting for an investment of $545 million. Of the bitumen that has been found, 90 percent is under 10° API — unacceptable and unworkable in the past. Now things have changed, thanks to the research carried out jointly by BP Research International and Intevep to find means of formulating a satisfactory emulsion and making its transport possible.

The initial research was confined to the problems of transporting these heavy bitumens without the use of heat or costly diluents which would have been necessary in the past.

By 1983/84 the researchers had found ways of emulsifying the bitumen with a cheap component — water — in order to transport the previously solid black liquid. However, not until later

Pilot plant at San Diego in the Orinoco Belt.

Part of J20 gathering station.

was another property discovered — the emulsion could be burnt with a very high efficiency in the boilers of power generation plant. It can in fact represent a substitute fuel for previously coal or oil-fired power stations.

Production

Production is by means of the 'steam soak' method. Water and additives are injected into the well to form a low viscosity bitumen-in-water emulsion, thus effectively diluting the bitumen. This system also lengthens the time between steam injection cycles, which improves the economics of the project. This primary emulsion is then dehydrated, degassed and desalted. At the processing plant at Morichal, more water and surfactants are added to form the Orimulsion emulsion. At present Orimulsion for export is pumped by pipeline to Punta Cuchillo on the Orinoco River, where it leaves by tanker. Now, however, a pipeline is being built to Jose on the north coast, where larger tankers can be accommodated. Once the Jose terminal is completed with an export capacity of over 50 million tons annually, Punta Cuchillo will no longer be used.

Production capacity at Morichal is currently 50,000 b/d. With a second plant scheduled to come onstream shortly, this is now being increased by 100,000 b/d, with a targeted output of 700,000 b/d by 1997.

Orimulsion proponents assert that the new fuel can be 'easily handled and burned in power stations and that it can be used in any fossil fuel plant with minor modifications'. Initial pilot and commercial tests by boiler manufacturers and in power stations in Canada, the United Kingdom and elsewhere, confirmed these statements. More recently, Orimulsion has also been tested satisfactorily at Texaco's gasification plant in California and has been considered for a similar plant in Sweden. These tests proved that the new fuel could be used as an alternative to conventional fuels in gasification processes — which might develop into important markets in future years.

Marketing

Since the first cargo of Orimulsion left Venezuela in 1988, a number of sales contracts with power generating companies have been signed. At present these total 7.9 million tons a year, with negotiations with another 10 companies going on for a further 12–13 million tons annually, and preliminary feasibility studies being undertaken for yet another 12 million tons. However, not all the contracts have started up yet — for instance, shipments of 4 million tons a year to National Power for Pembroke, do not begin until 1993.

Further sales possibilities are still being explored — in Portugal, Spain, Australia, New Zealand and the United States.

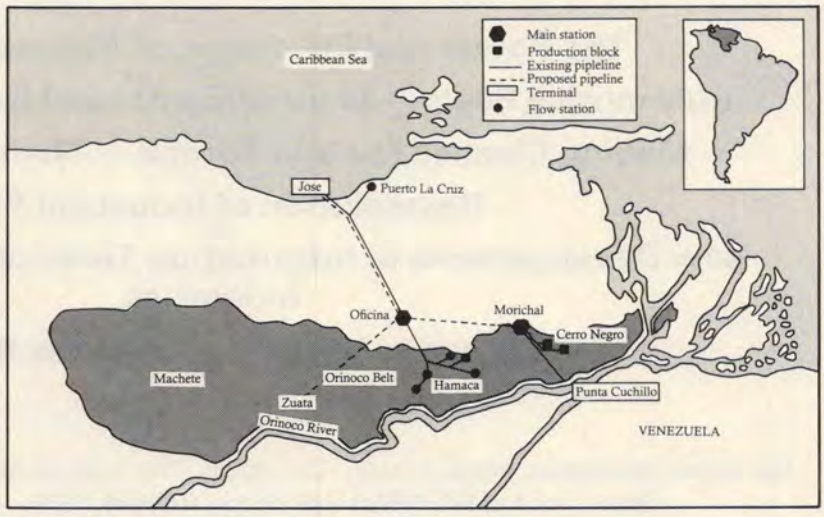
The three operating companies, Lagoven, Maraven and Corpoven, are responsible for the production and transport of Orimulsion as far as the coastal terminal. Separate companies have been set up by PdV to market round the world and offer technical advice to would-be buyers. These include BP Bitor, a joint company with BP, which markets in Europe, Bitor America, Bitor International (for Central and Eastern Europe and North Africa) and MC Bitor. A new joint company with Mitsubishi, responsible for sales to Japan, is starting operations now, following studies that have been done on the feasibility of shipping the new fuel to Japan via the Panama Canal.

Marketing activities are still at a threshold, with long-term sales difficult to predict. However, the companies involved are confident that their new product, with a price tied to coal, will be able to find substantial market in idle power stations previously fuelled by heavy fuel oil, aiming for a share of the base-load market.

Environment

Generally speaking, an environmentally friendly product, Orimulsion can be burned in conventional boilers and proven technology permits established limits for pollutants to be met.

As far as particulates are concerned, Orimulsion produces significantly less than coal; there is a minimum of



Orinoco Belt, Venezuela.

unburned hydrocarbon and no acid smuts, sometimes associated with oil-fuelled power generation. With electrostatic precipitation facilities which are recommended for Orimulsion-fuelled power plants, the emission of particulates is reduced to very low levels. In addition, the ash from Orimulsion contains a large quantity of metals, including vanadium, nickel and magnesium, which could be recovered and sold, depending on their market prices.

Nitrogen oxide and carbon dioxide emissions are less than coal and similar to heavy fuel oil, while the new fuel can be used with low NOx burners, to ensure that NOx levels are lower than the limits set by the EC for 1996 onwards.

However, the picture is not as rosy with respect to sulphur dioxide because of the fairly high level of sulphur in Orimulsion, causing higher sulphur dioxide emissions than 3.5 percent sulphur heavy fuel oil but less than 2.5 percent sulphur coal. However, wherever local environmental legislation limits sulphur dioxide emissions, various technologies exist, and more are being developed, to remedy this problem at various stages in the combustion process — before, during and after combustion.

Before combustion, the fuel can be gasified and the sulphur compounds removed before burning the gas — with potential for use in more energy efficient power generation systems, such as combined cycle power plants. During combustion, sorbants such as limestone can be used to absorb the sulphur dioxide. The sulphur compounds are then removed in an electrostatic precipitator. After combustion flue gas desulphurisation can be achieved with sorbants located between the boiler and the chimney.

Future

Research continues into improving Orimulsion and its properties.

One of the targets at Intevep's research facilities outside Caracas is to increase the ratio of bitumen in the emulsion to 80 percent, thus enabling additional savings to be made on transport. Another research aim is to find alternative cheaper surfactants with which to formulate the emulsion.

The major problem, however, is to manufacture a product that is totally 'clean and green'. Some technologies already exist to cater for sulphur emissions but Intevep researchers are taking on a bigger challenge — they are aiming for a sulphur-free bitumen, trying to find means of eliminating sulphur from the bitumen at the beginning of the chain, perhaps by using anaerobic bacteria. If they are eventually successful, Orimulsion's future will be even more assured. ■

IP Information Service News

Library/Information — staff contact list

Loans and periodicals — Liliana El-Minyawi, Library Assistant
Library holdings and use of library — Vivien Carmichael, Assistant Librarian
Information queries, online searches, statistical information — Lyn Nevin and Julia Clark, Information Officers
Catherine Cosgrove, Head of Department
IP Statistical Service subscriptions — Julia Clark
IFEG — Catherine Cosgrove

A full list of charges and details of the services offered are available upon request.

Times of service

Visitors welcome 9.30 am to 5 pm
Telephone queries 10.00 am to 5 pm
Monday to Friday, except Bank Holidays
Library, 61 New Cavendish St, London W1M 8AR

1992 pricing for information services

Most of our charges remain the same as 1991, but the following changes have been made.

Desk research will now cost £25 an hour for members, and £50 an hour for non-members.

Use of the Library will still be available to non-members. A full day's visit will still cost £10, but a half day will cost £6. Members free!

Educational booklets will still be free for the first copy, but 60p each for extra copies.

IP Statistics Service. The 1991 subscription will be extended to take in the issue giving the year end figures. Subsequent annual subscriptions will run from the issue giving the first quarter statistics, to the issue giving the year end figures — approximately May to April. Renewals for the 1992 subscription will therefore be sent out in February. The subscription will cost £25 for UK and European subscribers, and £30 for the rest of the world.

IFEG News

BS 5750 accreditation

Congratulations to Andy Dawson (IFEG's Honorary Treasurer) and the Information Centre of Taywood Engineering, for becoming the first library and information service ever to achieve independent quality registration from BSI under BS 5750: Part 1. The centre's scope under registration covers the '. . . provision of an information service to the Taylor Woodrow Group of companies and to external subscribers . . .' and its certificate, awarded on 14 November, now proudly adorns the centre's wall.

Ray Hughes

Our sincere thanks go to Ray Hughes, who has retired as a committee member. Ray was a founding member of IFEG and attended nearly every committee meeting since 1984, despite having to travel down from ICI in Wilton, Middlesbrough.

IFEG AGM

At the AGM held on 5 December 1991 — two new committee members were elected — Anneliese Cocks of Amerada Hess and Edward Bush of Amoco.

The Information for Energy Group provides a forum for those interested in the provision, evaluation and dissemination of information relating to all aspects of the energy industries. If you are interested in joining, contact Catherine Cosgrove on 071-636 1004 ext 210.

Selected additions to Library stock

Directories

Financial Times oil and gas international year book 1992. Longman. 1991.
Financial Times who's who in world oil and gas 1991/92. 10th ed. Longman. 1991.
Guide to worldwide bunkering services. Lloyds of London Press. 1991.
International Pipeline and Offshore Contractors Association 1991–1992 Directory/Yearbook.

Exploration and geology

The Arabian Plate: producing fields and undeveloped hydrocarbon discoveries (1990). American Association of Petroleum Geologists. 1991. Map
United Kingdom oil and gas fields: 25 years commemorative volume. The Geological Society. 1991.

Offshore safety

Accident Data 1990. The Oil Industry Exploration & Production Forum. September 1991.
Assessment of the suitability of stand-by vessels attending offshore installations: instructions for the guidance of surveyors. Department of Transport. HMSO. 1991.
'Ocean Odyssey report'. *Determination by R D Ireland, Sheriff Principal of Grampian, Highland and Islands in Fatal Accident Inquiry into the death of Timothy John Williams on board Ocean Odyssey.* Sheriffdom of Grampian Highland and Islands at Aberdeen. 8 November 1991.
Offshore operations post Piper Alpha. Institute of Marine Engineers; Royal Institute of Naval Architects. IMarE. 1991.
Offshore safety and reliability. Cox, RF and Walter MH, eds. Elsevier. 1991.

Offshore general

Breaking wave loads on immersed members of offshore structures. Department of Energy. Report OTH 89 311. HMSO. 1991.
Offshore Europe 91: proceedings of the conference held Aberdeen 3–6 September 1991. Society of Petroleum Engineers. Spearhead. 1991.
Recommended measures to improve the availability and quality of high priority quantitative risk assessment data. Oil Industry International Exploration and Production Forum. 1991.
API RP 14E. *Recommended practice for design and installations of offshore production platform piping systems.* 5th ed. API. 1991.

Finance and management

Director's guide to energy management. Institute of Directors. Director Publications Ltd, 1991.
Oil investment in the North Sea. Oxford Institute for Energy Studies. 1991.

Technical

BS 7117 *Metering pumps and dispensers to be installed at filling stations, and used to dispense liquid fuel.* Three parts. BSI. 1991.
CRC octane number requirement survey 1990. Coordinating Research Council. 1991.
Effect of gasoline octane quality on vehicle acceleration performance. Coordinating Research Council. 1991.
Motor vehicle emission regulations and fuel specifications — 1991 update. Report 3/91. CONCAWE. 1991.

'We are at the chrysalis stage'

Last year Elf and Enterprise created a major new North Sea company which owns a stake of around 19 percent of the 450 million barrel Nelson field and all of the UK licence interests acquired from Occidental by Elf Aquitaine. The new company is Elf Enterprise Petroleum Limited. Michel Romieu transferred from his former position as Managing Director of Elf's operations in Nigeria to become Managing Director of Elf Enterprise Petroleum Limited and Chairman and Managing Director of its operating company — Elf Enterprise Caledonia Limited. He talks here of the new company's aims and objectives.

What are your first impressions of the company?

I am very impressed by the quality of the team and the work being accomplished — both are outstanding. The company is a true innovator in terms of its quality management programme and its remarkable application of the safety concepts included in Lord Cullen's recommendations.

It's important to remember that the success of Elf Enterprise will depend on the quality of the people working for the company — their experience and their potential — just as much as on the quality of the reserves and other physical assets. These factors were taken into account when the two companies considered setting up the joint venture after the purchase of Oxy UK.

How important is Elf Enterprise to Elf Aquitaine and Enterprise?

The two shareholders have high ambitions for this new company. The fact that Mr Loïk Le Floch-Prigent, Chairman of Elf Aquitaine, and Mr Graham Hearne, Chairman and Managing Director of Enterprise, are both on the Board of Directors of Elf Enterprise shows immediately how much importance is placed on this company.

We now have to establish the credibility of the new company by conducting our business successfully. We have a great deal to do in terms of our existing exploration, production and development programmes.

Elf Enterprise Petroleum represents a mighty alliance of two international companies. Enterprise has a dynamic and outstanding reputation in the UK oil industry and financial community; Elf is the foremost industrial conglomerate of France with a lot of driving power and financial muscle.

Both companies are fully committed to the long-term future of their joint venture; but first we must fulfil their expectations of our existing operations and projects. We are at the chrysalis stage at the moment; after we have proved ourselves during the coming year, then we can start building the company's future.

What are your immediate goals and objectives for Elf Enterprise?

We have three main goals which have been set by Mr Le Floch-Prigent and fully endorsed by Mr Graham Hearne.

Our first goal is the continuity of our existing operations particularly with regard to completing the development of the Piper, Saltire and Chanter fields on schedule and within the approved budget next year. We will serve our two shareholders well by successfully carrying out these programmes to the very best of our ability; by doing so we will inspire their confidence in the company for the future.

Our second goal concerns the integration of EECal staff into the Elf organisation.

There are good opportunities for career development within the Elf structure. The exploration and production branch of Elf employs a large number of people in international operations throughout the world. For those of our employees who are able and willing to follow the future development of the Elf Group worldwide, opportunities can be found by expatriates and UK nationals alike. Elf's operations are expanding quickly and there are not large numbers of people available from within Elf.

We recognise that the transition period will be delicate to manage and we will continue to work closely with Occidental. We will also examine what opportunities exist for internal promotion, for local employment and perhaps for transfer within the Elf Group.

We have a set of objectives for this company to meet and we know what resources will be required to achieve those objectives. Our manpower requirement will be met first of all from the pool of talent that exists already within EECal, then we will recruit locally and finally we may approach the Elf group — but we will have to be very persuasive because of the group's own manpower needs.

Our third goal concerns exploration. Elf Enterprise's ratio of reserves to production is very satisfactory. As operators, we have over 600 million barrels of oil and not many other companies can make that claim. The Saltire discovery has added about 150 million barrels into this picture. But we have to remember that we must replace every barrel we produce by finding new reserves. Personally, I will only be satisfied when for every barrel which we produce, we have discovered substantially more than one barrel.

Michel Romieu

Our prime acreage is in the Piper and Claymore areas where there are still more reserves to find. We also have the North and South Graben areas both of which are very promising geologically and well served by oil and gas pipeline systems.

We will continue to search systematically for medium-size fields in these areas with a view to developing them profitably by using existing platforms. Occidental Petroleum (Caledonia) Ltd (OPCAL) has already done this very successfully with the Scapa, Chanter and Saltire fields. So, our first exploration priority is to hunt for more reserves in our mature areas.

Secondly, we will explore our new 12th Round acreage in the English Channel, in which we have a 100 percent interest, and our other blocks in that area. It's evidence of the government's confidence in the company that we have been awarded acreage in this sensitive area. We will ensure that the environment continues to be fully protected throughout all our activities.

Our third exploration priority is to acquire new acreage through new ventures and farm-ins. This will be one of the ways Elf and Enterprise will bring added value to the new company and reflects their long-term outlook for the future of the company.

The support of your 4th Round Consortium partners — Texaco, LASMO and Union Texas — is central to the success of your existing operations. Have the partners welcomed the creation of Elf Enterprise?

When I arrived, I was concerned about our relationship with our partners because as operator we have an obligation to give them good service — we have to serve and respect — that is the Elf philosophy. The partners pay their share of the consortium's bills so we need to render service to them and to report properly. Since my arrival here, I have been reassured that the rapport with our co-venturers is fundamentally healthy. We are managing a development programme — Piper, Saltire and Chanter — which will cost the Consortium a total of £1.3 billion. You can't manage a programme on that scale successfully and maintain the consortium's other operations, without solid support from your co-venturers. The fact that recently they unanimously endorsed the remaining work programme for Piper B and Saltire A projects shows that fundamentally they respect and trust OPCAL — now Elf Enterprise. But you should always look for ways to strengthen the partnership and we are doing just that.

How would you like Elf Enterprise to be perceived?

We have to establish clearly our position as one of the United Kingdom's major operating companies which we shall be when Piper B, Saltire and Chanter come on stream this year.

It will become apparent that this company is setting real precedents in terms of its approach to offshore safety — of people and the environment. We have treated the Piper B and Saltire projects as test cases for the development of new safety concepts which we intend to apply throughout the rest of our operations.

We are also dedicated to providing a reliable transportation service for other operators who use or could use our pipeline system and terminal facilities. Flotta terminal is very reliable and well maintained; it's one of our prime assets and it could provide a service to more offshore producers.

So, as Elf Enterprise becomes established, it will gradually build a reputation for being a dynamic and responsible operator.

In 1990, Elf's Hydrocarbon Division invested a total of £54.6 million in research, development and innovation activities — a major commitment to its future oil and gas operations. Will research and development be given the same priority in the United Kingdom by Elf Enterprise?

Elf UK, Enterprise and OPCAL have all made significant investments in research and development in the United Kingdom. Elf Enterprise will also have a clear policy on its research and development which will be consistent with the company's needs and what the Elf Group is doing on a corporate basis.

So we will analyse our existing activities, with the support of the Elf Group, to see if OPCAL's R&D activities meet the criteria of the group. Then, we will set up a long-term plan for Elf Enterprise's R&D reflecting the company's needs and our major presence in Scotland.

Like exploration, the company's research and development strategy can only be meaningful if it looks ahead for a minimum of 5–10 years. We will develop a long-term approach which will satisfy the criteria of our shareholders and meet the needs of Elf Enterprise. ■

Acknowledgement
This interview first appeared in the Elf Enterprise Quarterly Review.

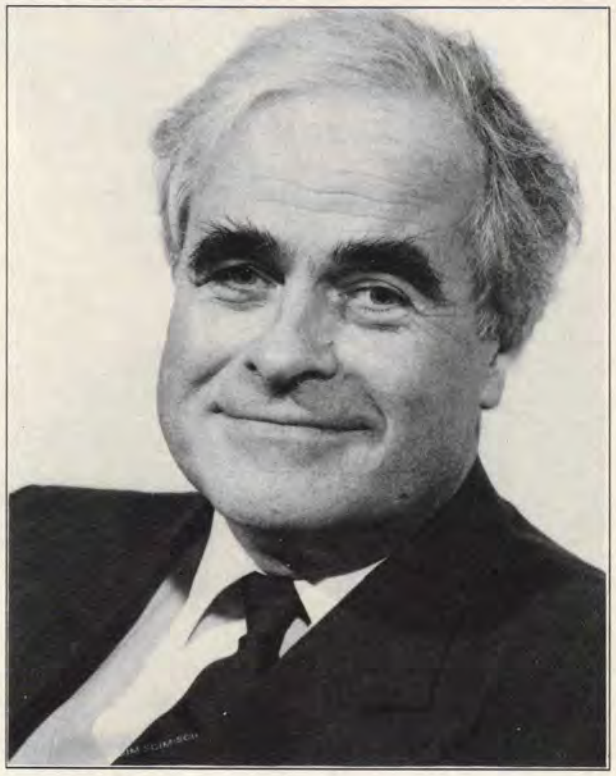
The soft side

By Rev Andrew Wylie

'Thanks to the offshore industry the United Kingdom is now officially out of the recession'. So began a recent broadcast but maybe the most astonishing feature of Britain's colossal offshore undertaking is that although so economically crucial, very little is known, let alone understood, about it by the vast majority of people. In the 1960s a royal finger pressed a button and an uncomprehending public applauded what could be dimly perceived as the beginning of a remarkable exercise in technology. Since then, despite a dim awareness that the price of Brent crude is very important to the economic well-being of the United Kingdom, there has been little heightening of public understanding of what really goes on and who the people are who make it all work. There are the moments when the offshore industry becomes front page news but sadly these occasions have usually been when there is accident and loss of life. The general reaction has been that these tragedies confirm the popular conception of an extremely hazardous enterprise conducted in a hostile environment. No-one would, or could, dispute the inherent risk within the operation and certainly no-one who works offshore would deny that the weather leaves much to be desired. However, the accident rates are astonishingly low compared with many other areas of industrial activity and there are times when the weather can be sublime and the beauty of the northern North Sea (yes, it can be beautiful!) leaves an indelible impression.

The Chaplaincy to the Offshore Oil Industry began six years ago and from quite early on it became very apparent that, although there might be a novelty aspect in a cleric being offshore, the Church was merely seeking to serve and support ordinary men doing ordinary jobs. It was only the situation that was extraordinary.

During these past years so much has happened. There has been disaster of vast dimension and there have been individual tragedies that have had very considerable impact on the tight-knit families that make up the offshore population. To have been able to share in these times of heartbreak has been a privilege and through a shared sorrow has come a very profound relationship. But as well as the bad times, there have been many occasions full of fun and laughter. The many Christmases offshore with the joyful singing of carols (usually out of tune thanks to poor leadership!) are equally memorable but, most of all, there have been the day-in, day-out opportunities to share with a workforce in their everyday joys and sorrows. Of course, every sort of work produces its own difficulties. But for some who work offshore the totally predictable, relentlessly regular absences from home can produce very real problems (the 'intermittent husband' syndrome). This is particularly the case where authority with children and decision-making in the running of a home are involved. There is a high marriage casualty rate although it well may be that the absences merely exacerbate already unsatisfactory relationships. Conversely there are many old hands who find that working offshore has provided them with a quality of life at home and a consistency of presence that is not available to many working couples. There are others who become enmeshed in an economic trap (the golden handcuffs) when they discover they personally would wish to work onshore for less reward, but whose families have become



Rev Andrew Wylie

'There are times when the weather can be sublime'

accustomed to a relatively affluent lifestyle which they would find hard to give up.

When the Chaplaincy began, the terms and conditions of operating company personnel and contract employees were marked by their difference. In the writer's unhappy experience of those days, there really was an industrial apartheid operating offshore. Happily, so much has changed for the good. In the bad days it was not only that morale was low but more alarmingly people were ill at ease with one another and deeply disturbed, feeling powerless in their ability to create a change for the better. The new working relationship between operator and contractor has done nothing but good and a much healthier atmosphere exists within the whole workforce. Surely, this must bode well not only for the well-being of all those who work in the North Sea but equally it must make a significant contribution to offshore safety.

'The Church was merely seeking to serve and support ordinary men doing ordinary jobs.'

Over the years, there have been frequent opportunities to talk to different clubs and societies about the human factors in the offshore enterprise and at the same time, these have been opportunities to try to dispel some of the myths that surround the whole operation and to inject a sense of reality into the understanding of who it is who works over the horizon. The offshore workforce must be most unusual in industrial history in that essentially it is invisible. Once the worker comes onshore and steps out of his helicopter, he joins a great dispersion by air, road and rail to homes throughout the mainland and beyond. It is a workforce that only has cohesiveness when at its place of work. Therein maybe lies its distinctiveness. The distinction of belonging to a group of men and women marked by individuality of character, yet all members of the offshore family. At the same time, the unique factor seems to lie in an inability to produce some sort of corporate identity and this can be particularly frustrating to those who work offshore but come from an industrial background where traditionally there is a strong sense of homogeneity.

Most critically of all, it is important to dispel the macho myth which surrounds the offshore worker. The ever-increasing presence of women in the North Sea will eventually produce a greater awareness of reality; at a light-hearted level their presence and the consequent evidence of after-shave has helped to ameliorate the sometimes excessive masculinity of some installations! But, more seriously, the macho image can be counter-productive where safety is concerned. No man is an island; everyone needs support and encouragement, everyone has a tolerance level beyond which they should not go. There is a cliché that in some circumstances, it's all right not to be all right. The acceptance of this truth could prevent much anguish and still further diminish the possibility of accident.

Frequently, the image of the offshore industry that is presented to the public is either of gaunt steel structures set in the ocean with never a human being in sight, or of frenetic activity on a drilling floor. Little is ever depicted of other aspects of offshore life. Certainly the reputation for good food is justified but the uniqueness of the industry in being residential, and its implications, sometimes does not appear to be fully understood. Where else do people voluntarily eat, sleep and work in the same place? The implications for companies who employ a workforce which will spend only

'It is important to dispel the macho myth.'

half of its working life at home are very considerable. There are two families in the offshore scenario and they have to learn to live together and a division of responsibility has to be accepted by both parties.

It is very easy to become so involved in the technology that the prime investment of the industry, which is in its people, can be easily overlooked. There can be no bottom line unless there are the trained minds and hands who make everything possible and the years spent offshore make it most plain that nothing but the best is good enough for a workforce that is marked by its generosity to others (gifts for charitable purposes are quite amazing), its loyalty and its courage.

At a recent lecture a speaker projected a slide of a well-stocked self-service counter on a platform and then went on to suggest that good food and a clean bed are all that the industry has to supply to satisfy the offshore worker and achieve the bottom line required. The years of Chaplaincy would suggest that this is a desperately shallow and insensitive understanding of the men and women who make that very special world revolve. They need support in their times of difficulty; they need understanding when they seem to be restless; they need sensitivity in provision for their living accommodation.

Postscript

We stood in the shelter high above a grey, heaving, uninviting sea whilst a wind from the Arctic buffeted the platform. Andy — why ever do you come out here? I have come because you matter, you are important as an individual, you are important to God and you are not forgotten.

The offshore worker may be out of sight but he must never be out of mind and enormous gratitude is expressed to all those operating companies who have been the enablers in making the Chaplaincy possible through their generosity and their trust. It is not easy to leave — it is wonderful to have been involved. ■

ENVIRONMENT DISCUSSION GROUP

The next meeting of the Environment Discussion Group will be held at the Institute on **Tuesday, 21 January 1992,** starting at 5.30 pm. Tea and biscuits will be available from 5.00 pm.

Environmental audits

Speaker: **Mr Andrew J Miles,** Associate Director, Radian Ltd.

If you would like to attend this meeting, please contact **Mr A E Lodge,** Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Telephone: 071 636 1004.

Occupational exposure limits for hydrocarbon solvents

By Dr Tom Farmer, Solvents Industry Association

Although a number of occupational exposure limits (OELs) for single component hydrocarbons appear in recognised tables, few multi-component hydrocarbon solvents are listed. The main exceptions are White Spirit (Ref. 1) and Stoddard Solvent, Rubber Solvent (Naphtha) and VM and P Naphtha (Ref. 2). The main multicomponent solvents are produced by several companies to very similar specifications and it is desirable that agreed OELs are quoted for these products in order to avoid unnecessary confusion. To state the obvious, the objective in assigning OELs is to give guidance in order that solvents may be safely handled in the workplace in **all foreseeable situations.**

Basically there are three scenarios to be considered:

i) Vapour arising from the handling of solvent in the liquid phase.

ii) Vapour formed from a fugitive escape.

iii) Vapour produced by a drying film.

Since the mid 1970s, the Solvents Industry Association (SIA, formerly the Hydrocarbon Solvents Association) has published lists of OELs, based on its members' products, and these figures have been accepted by the major part of the UK industry (Ref. 3). In producing these recommendations, the SIA has employed the 'reciprocal calculation procedure' as described by the American Conference of Governmental Industrial Hygienists (ACGIH, Ref. 2), consideration being given to different companies' products:

$$\frac{1}{OEL_{sol}} = \frac{Fr_a}{OEL_a} + \frac{Fr_b}{OEL_b} + \ldots\ldots\ldots + \frac{Fr_n}{OEL_n}$$

where

OEL_{sol} = occupational exposure limit of the hydrocarbon solvent

OEL_a = occupational exposure limit of the component a .....

Fr_a = Fraction (w/w) component a in the solvent .....

In using this approach, a number of assumptions have to be made:

a) The effects of components a, b, c.... are additive.

b) The composition of the vapour is the same as the composition of the liquid solvent.

c) For components which do not have listed OELs, values based on similar molecules eg isomers, are assigned.

d) Products boiling above 200°C are likely to form mists.

By employing the OELs shown in **Table 1**, the OELs which appear in **Table 2** (Ref. 3) were obtained in the last revision in 1988. The value for n-hexane will be 70 mg/m³ as from the first of this month and will change the calculated OELs for SBPs 1, 2 and 4, the new figures being shown in parentheses.

It has to be admitted that, the use of the 'reciprocal calculation procedure', has both advantages and disadvantages and it is necessary to weigh the pros and cons before making a final evaluation of this approach.

Advantages

1) The contributions of all components are taken into consideration.

2) Calculations are simple, easily 'computerised' and allow facile periodic review.

3) In general, it is felt that the results tend to be slightly 'pessimistic' ie err on the safe side (see later discussion).

Disadvantages

4) Detailed analyses of the solvents are required.

5) Products containing 'unpleasant' components concentrated in the lower boiling fraction and those boiling above 200°C require special consideration (see later discussion).

6) It is desirable for the solvents to contain a number of 'marker' components with recognised exposure limits.

In support of statement 3) above, the comprehensive work of CP Carpenter et al (Ref. 4) was examined. These

Table 1

Hydrocarbon	*OEL*
Benzene*	30mg/m³
Butanes	1,430
Cumene	245
Cyclohexane and isomers	1,050
Cyclopentane	1,720
n-Decane and isomers	640
Ethyl benzene	435
n-Heptane and isomers	1,600
n-Hexane	180 (70)
n-Hexane isomers	1,800
Methyl cyclohexane and isomers	1,610
Naphthalene	50
n-Nonane and isomers	1,050
n-Pentane and isomers	1,800
Toluene**	375
Trimethyl benzenes	125
Xylene isomers	435

*Current value (Ref 1) is 15mg/m³. Benzene is present only in trace quantities in commercial solvents.

**Current value (Ref 1) is 188mg/m³. This change does not significantly affect the figures shown in Table 2.

Table 2

Solvent	OEL	
Commercial hexane (n-Hexane approx 50%)	360 (135)mg/m^3	100 (30)ppm
Special Boiling Point Solvent 1	600 (310)	150 (80)
Special Boiling Point Solvent 2	490 (260)	125 (60)
Special Boiling Point Solvent 3	1,300	300
Special Boiling Point Solvent 4	520 (270)	125 (60)
(n-Hexane content greater than 5%)		
Special Boiling Point Solvent 5	1,260	300
Special Boiling Point Solvent 6	500	100
Special Boiling Point Solvent 7	800	175
Special Boiling Point Solvent 8	1,400	300
Special Boiling Point Solvent 11	430	75
Rubber Solvent	1,020	200
White Spirit (Ref 1)	575	100
High Flash Point White Spirit	510	75

NOTE. The OELs in ppm are quoted to the nearest 25ppm, not to imply accuracy but to indicate that the values are calculated.

researchers investigated several American grade hydrocarbon solvents employing 90-day animal inhalation studies and recommended 'hygienic levels' for an 8 hour working day. (It must be stated that, in the 1970s, possible neurotoxic effects were not considered). **Table 3** illustrates the comparison between the Carpenter recommendations and the results of calculations using the 'reciprocal procedure'.

The table shows that in no case does the calculated value exceed Carpenter's or the ACGIH quoted figure. This result lends credibility to the use of the procedure.

Concerning those volatile solvents containing 'unpleasant' components in the lower boiling fraction (see 5 above) it is sometimes stated that the liquid composition does not relate to the vapour composition, hence the calculated OEL could be optimistically high. Specific examples are the Special Boiling Point Solvents 1, 2 and 4 which contain appreciable quantities of n-hexane. For these solvents, it would seem reasonable to calculate the equilibrium vapour compositions, assuming no azeotrope formation, and derive the corresponding OELs. **Table 4** summarises the results of such an exercise. The figures in parentheses relate to the use of an exposure limit of 70 mg/m^3 for n-hexane in the calculations.

Only for SBP2 does the vapour composition give lower calculated OELs and the differences, being small, can be dealt with in the normal rounding of figures for the final table. However, it would be prudent to undertake this type of investigation for any products which contain volatile 'unpleasant' components.

The problem of high boiling solvents (see 5) above) also has to be addressed. For the scenario where vapour is produced by handling liquid solvent (i) above], it would seem reasonable to quote an OEL based on the vapour pressure at a given ambient temperature, assuming that there are no extraordinary toxicological considerations, since concentrations above those relating to the vapour pressure will result in the formation of a mist. Mineral hydrocarbons mists have a recognised exposure limit of 5 mg/m^3 which, for a C14 aliphatic hydrocarbon, equates to an aerial concentration of 0.6 ppm. Any such exposure limit would need to be qualified by the relevant temperature and to avoid quoting a number of exposure limits for a range of ambient temperatures it might be considered acceptable to standardise on one temperature eg 15°C. The hygienist would then be able to adapt the value for any given situation.

Fugitive escapes, present a less likely scenario, but do pose a special problem. Pure compounds will produce mists as soon as the saturation vapour pressure is exceeded. However, for multicomponent solvents, the picture is more complex as the concentration at which a mist will form will depend upon the highest boiling components. In the absence of techniques for determining a mist in the presence of vapour, the problem requires detailed analysis combined with the use of a computer. A more empirical approach (Ref. 5) uses the Engler distillation curve and, in the first approximation, should prove acceptable. Inevitably, the investigation of a fugitive escape will lead to a lower, vapour pressure based, OEL for a multicomponent solvent. Normally, the fugitive escape scenario will not persist for long periods of time, but where it does note should be taken of the lower calculated OEL. The effect of this scenario is exemplified by the hygienic level recommended by Carpenter et al (Ref. 4) for deodorised kerosine (14ppm). This concentration was the maximum level which the experimenters could achieve by totally vaporising the solvent under ambient conditions. Examination of the published physical properties of deodorised kerosine indicate that, at 15°C, in the normal situation of vapour arising from the liquid solvent a concentration of 160 ppm is possible. **Table 5** shows suggested OELs for a number of

Table 3

Product	Carpenter's recommendations ppm	Carpenter's recommendations mg/m^3	Calculated values ppm	Calculated values mg/m^3
VM and P Naphtha	430	2,190	160 300**	810 1,370**
Stoddard Solvent	200	1,290	80 100**	527 525**
Rubber Solvent	430	1,860	190 400**	830 1,570**
Mixed Xylenes	110	520	100**	473**
60 Solvent	90	480	80	410
70 Solvent	59	350	30	160
80 Thinner	100	470	100	460
50 Thinner	430	1,860	180	800
Toluene Concentrate	480	2,080	140	620
High Aromatic Solvent	26	163	20	122
Naphthenic/Aromatic Solvent	380	2,290	170	1,040
n-Nonane	590	3,380	200**	1,050**
140 Flash Aliphatic Solvent	37*	250*	Forms easily	mist
Deodorised Kerosine	14*	110*	Forms easily	mist
40 Thinner	25	170	15	100

*Values limited by vapour pressure.
**ACGIH values.

Table 4

Solvent	Typical n-hexane content	Typical boiling range	OEL based on the composition of: LIQUID	VAPOUR
SBP 1	18% w/w	49–115°C	660mg/m³ (310) 170ppm (80)	780mg/m³ (400) 210ppm (110)
SBP 2	21	70–94	580mg/m³ (260) 140ppm (60)	460mg/m³ (210) 110ppm (50)
SBP4	20	54–145	600mg/m³ (270) 140ppm (70)	670mg/m³ (320) 180ppm (90)

hydrocarbon solvents in the latter scenario, the values being based on the initial boiling points. (This method probably underestimates the saturated vapour concentrations.)

Finally the scenario relating to the steady evaporation of the solvent say, from a film, has to be considered. In this situation the composition of the vapour will be constantly changing and normally, in the workplace, will be removed by adequate ventilation. Any vapour present in the atmosphere and available for inhalation will arise from diffusion. It has to be decided whether any particular stage in the evaporation cycle presents a problem. An empirical approach involves an examination of the solvent vapour compositions corresponding to the liquid solvent and solvent 33 percent and 67 percent evaporated. Note should be taken of the lowest calculated OEL if the related stage in the evaporation cycle exists for a significant period of time. For the majority of hydrocarbon solvents the 'liquid based' OEL should be adequate.

Conclusions

1) The ACGIH 'reciprocal calculation procedure' is an acceptable method for assigning OELs to multicomponent hydrocarbon solvents.

2) In situations where solvents contain volatile 'unpleasant' components it is prudent to consider calculated OELs based on both the liquid and vapour phase compositions and assign the lower figure.

3) For high boiling solvents, owing to the possibility of mist formation, the assigned OELs should not be greater than the saturation vapour concentration at say 15°C. Such levels may be adapted by the hygienist to relate to unusual conditions. Multicomponent high boiling solvents need to be carefully considered in the fugitive escape scenario if significant periods of time are involved. An empirical approach, based on the Engler distillation curve, is suggested as a simple procedure.

4) In general, OELs based on the liquid composition should be acceptable but it is desirable to consider all scenarios in appropriate cases.

5) There is a real need for a reliable method for determining oil mist in the presence of vapour. Perhaps the analysis of a sample before and after centrifuging at a controlled temperature would solve the problem. ■

Table 5

Solvent type	Boiling range °C	Suggested OEL (Estimated Saturation vapour concn 15°C)
Aliphatic Hydrocarbon	220–270	80ppm
Aliphatic Hydrocarbon	240–270	30
Aliphatic Hydrocarbon	260–280	< 10
Aliphatic Hydrocarbon	295–340	< 10
Aromatic Hydrocarbon	260–290	< 10

References

1) EH 40/91 Occupational Exposure Limits 1991. (Health and Safety Executive, UK).
2) Threshold Limit Values and Biological Exposure Indices 1991/1992. (American Conference of Governmental Industrial Hygienists, Ohio, USA).
3) Solvents — A Guide to Safe Handling. (Solvents Industry Association).
4) CP Carpenter et al, *Toxicology and Applied Pharmacology*, 1975,32,246: 1975,32,263; 1975,32,282; 1975,33,526; 1975,33,543; 1975,34,374; 1975,34,395; 1975,34,413; 1976,36,409; 1976,36,427; 1976,36,443; 1976,36,457; 1976,36,473; 1977,41,235; 1977,41,251; 1977,41,261; 1978,44,53.
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The Canadian offshore . . . at last!

By Colin S Deans

Since the first offshore well was drilled off the Canadian Atlantic coast in the mid-1960s, there has been excitement, anticipation and a good deal of political hype about the prospects for commercial development of the theoretically vast reserves of oil and gas in this region.

In the early 1980s many will recall the stir caused by the 'Venture' project, a mini gas gathering system near Sable Island off Novia Scotia. Although the Geological Survey Canada indicated as much as 30 trillion cubic feet (tcf) with an expected 12 tcf recoverable of which as much as 6 tfc may be near Sable, the project foundered on the economic and political uncertainties. Gas sales contracts were becoming shorter by the day and prices were falling by the hour. It was suggested that the Federal and Provincial Governments could front-end finance the pipeline at least, and the vehicle for such a scheme was already in place in the shape of Nova Scotia Resources Ltd, a 'crown corporation', owned by the government of Nova Scotia. Some even suggested that the NEEPOL (a group of utilities in north east United States) be brought to the table in an equity role.

Mobil Oil took the view that it wanted to own the facilities and the offshore pipeline, and the onshore gas receiving and separation plant *and* the onshore pipelines all the way to the US border but in the end lacked the finance or will to do anything. As Mobil could be said to have their hands somewhat full currently with the development of the Hibernia field, there is now increasing speculation that a farm-in would suit the Canadian governments and that the pump priming funding could be considerably easier to justify in the light of the massive public investment in the Hibernia project.

Nova Scotia

This was the scene of the first offshore production well drilling and the development of the first two fields — Cohasset and Panuke. Operated by a joint venture between Lasmo and Nova Scotia Resources Ltd., the fields are expected to produce some 38,000 barrels per day over the next six years. Already Lasmo have made a further significant discovery at the nearby Balmoral field and may hope to extend the life of the project.

Cohasset and Panuke are being developed utilising a converted jack-up, the *Rowan Gorilla III* as the main production facility. Two small steel wellhead jackets have been built and delivered by Heerema, while SBM have supplied a 'CALM' buoy and Coflexip have been busy last summer installing the interfield flowlines from their vessel *Flexserve II*. A contract has been awarded to Nordic American for the charter of the *Nordic Apollo* to serve as the floating storage and offloading facility for the project. At 128,000 dwt the tanker will have the capacity to store three to four weeks' production on site. Nordic American will also be providing the tanker *Nordic Challenger* to serve as a shuttle tanker, making some 30 round trips each production season. It seems that the 'COPAN' project, as it is becoming more familiarly known, is on target both time and budget wise and has managed to involve the local Nova Scotia companies in the provision of a wide range of services and fabrication work.

At the southwest end of Nova Scotia there lies an area offshore known as 'Georges Bank', which for many years was the subject of territorial dispute between the Canadian and US governments, primarily over the fishing rights. That dispute is now resolved and the prospects for exploration licences there as well as the Sable Island area should interest other small independents. At present the Nova Scotia Department of Resources should be looking at ways to force the hand of those oil companies which have already drilled and declared 'significant finds' and are tardy in developing these fields. The UK and the Danish legislation in that regard is, as we write, being studied closely.

Newfoundland

The first and largest project in Newfoundland is the long awaited Hibernia field development, with a kick-off budget of $Can5.2 billion for a field with current estimated reserves of some 525 million barrels. The project is being managed by Hibernia Management & Development Company, comprising Petro-Canada, Mobil Canada, Gulf Canada and Chevron Canada, and is drawing expertise and human resources from all partners. Massive public funding in various forms including grants, soft loans and underwriting has been used as inducement to the partners to start this project in the face of the economic realities. Some estimates of the total public exposure, allowing for fiscal take deferments, training and technology transfer allowances and substantial infrastructure provisions along with the costs associated with

The Cohasset jacket being installed by the McDermott derrick barge.

the massive bureaucracy monitoring all aspects of the project, iceberg and other environmental monitoring, and finally pollution control and response, may be as high as $Can3.4 billion. No wonder that the Hibernia project is seen by some as the largest public works project ever undertaken in Canada.

Seen in this light, therefore it comes as no surprise that there is strong determination on the part of the Federal Canadian and the Provincial Government of Newfoundland & Labrador to ensure maximum benefits from the project. It seems clear that only those non-Canadian companies who establish joint ventures will win contracts.

Indeed at time of writing, the scene is being dominated by the Aker group who developed the radical topsides solution and are the key player in the consortium (Newfoundland Offshore Contractors) who have been awarded the topsides engineering and procurement contract and the project services contract. Aker have also won the first major topsides construction contract, estimated at some $Can350 million in a consortium with two mainland Canadian companies and their small local Newfoundland partner. There is evidence that on the procurement of the 10,000 items required, the Norwegians are well ahead in the race for orders.

The Terra Nova project will be the next major development in Newfoundland waters and indeed if the permissions now being sought from the federal and provincial bodies, including the Canada-Newfoundland Offshore Petroleum Board, are granted by this spring, the Terra Nova project could well be on stream before the first oil from Hibernia. With capital budget in the region of $Can2 billion and reserves estimated at 300 million barrels, this project should look much more viable to investors.

Other significant discoveries offshore Newfoundland include Whiterose, some 50 km northeast of Hibernia. Estimated recoverable reserves are placed in the 200 million barrels range, and further delineation drilling is planned. The Hebron/Ben Nevis complex could hold in excess of 200 million barrels. Consultants Meneley Associates have projected the existence of at least one major field and some five to seven smaller marginal fields off Newfoundland.

Hibernia

Located 315 km east southeast of St John's in 80 metres of water, this field, first discovered in 1979, is estimated to contain 525 million barrels of recoverable oil. Production is planned at rates between 110,000 and 150,000 barrels per day for the 18-year projected life of the field. Between 50 and 80 wells are expected to be drilled, including several subsea wells to be gathered through a subsea production manifold.

The Panuke deck awaiting its loadout. *Photos courtesy of Nova Scotia Department of Natural Resources.*

A gravity based concrete structure (GBS) was chosen and the design and construction awarded to Newfoundland Offshore Development Contractors (NODECO). This consortium comprises McNamara (a Wimpey Canada company), Atlas Construction, Janin Contractors and Doris Engineering (part of the Sofresid group) of Paris, together with their local Newfoundland partner, Concrete Products. The $Can1.2 billion value contract includes the preparation of the greenfield site and all the permanent camp facilities which will be handed over (for the token $1) to the Government of Newfoundland & Labrador at the completion of the Hibernia loadout.

Engineering of the concrete platform is being carried out initially in Paris but is due to be detailed in St John's and all the construction will take place at Bull Arm north of St John's. The site was chosen for the proximity of deep water suitable for the mating of the topsides (by submersion of the GBS). In the light of the sudden catastrophic loss of the *Sleipner* GBS, some calls are being made for third party design and procedure audits especially in the light of the proposed 'single lift' (by deballasting) of some 33,000 tonnes of integrated topsides.

The design of the GBS is influenced, of course, by the presence of sea ice and the threat of icebergs, ranging up to two million tonnes, and is designed to withstand and absorb the energy of an impact with such a massive iceberg. The main base structure rises above the waterline before the four legs carrying the topsides emerge from the base structure. With this design it was clearly imperative to have a free-fall lifeboat system which directed the lifeboats well out and away from the base structure via a cantilevered steel frame. Loading and back-loading of supply boats will present the same problems from this 108 metre diameter caisson type base.

The topsides for the Hibernia platform are based on a radical design by Aker Engineering, part of the New-

foundland Offshore Contractors (NOC) consortium, which also includes Brown & Root, Monenco, SNC and local Newfoundland firm, BFL Consultants. NOC are based in Montreal with a smaller office presence in St John's. The topsides comprise five 'super modules', each weighing between 3,900 and 6,700 tonnes, and eight further small topsides packages. Total topsides weight is approximately 33,000 tonnes and will be welded together as one integrated topside unit prior to mating. Aker's design eliminates the need for any module support frame or deck, and is claimed by some to have saved over 10,000 tonnes and nearly $1 billion. In addition to the one 'super module' already awarded and to be built in Canada, there are four 'super modules' and three other topsides packages to be awarded on an international competition basis by this spring.

The Hibernia project is well underway with nearly 1,500 people employed and contracts awarded to date totalling some $2Can billion, removing doubts that this project would ever get started.

Terra Nova

Discovered in 1984 by Petro-Canada, this 300 million barrel field is to be developed in the near future, utilising a ship-shaped monohull floating production vessel with storage and offloading facilities. After consideration of all development options, Petro-Canada came down heavily in favour of the 'floater' option on grounds of cost, safety and environmental considerations.

Their preferred design is for a turret moored, ice class hull some 800 feet in length, 140 feet wide and with a displacement of 120,000 tonnes. The vessel would have thrusters and the ability to rapidly disconnect and reconnect, due to the presence of icebergs. Production facilities would include total fluids handling of 200,000 b/d for an oil production of some 165,000 b/d, and a crude storage of 650,000 barrels or five days production. The floating production system will be supported with up to three 120,000 tonnes tankers to shuttle the crude to market. A semi-submersible and the usual complement of supply and support vessels will be required. Petro-Canada believe that the future for offshore projects in this region lies with the floating systems which could be expected to develop the several marginal fields already delineated.

Future

There is no doubt that Canada requires to develop the light crude bearing fields on its East Coast or within a short time face the imbalance of energy/costs. There could also be an excellent market for the East Coast gas reserves in the adjacent US states. The politics of abundant supplies of oil and gas in Western Canada has so long prevailed against the development of these resources. The protectionism of Canadian enterprises is not in Canada's long-term interest and neither is the selling cheap of its natural resources in their 'raw' state. The need for landing and refining of the East Coast oil so that Canada might have the added value is clear and it is hoped that before arrival of the first oil from Hibernia or Terra Nova the infrastructure is in place to make that possible. ■

US states opt for stringent auto emissions standards

By Judith Gurney

On 29 October 1991, nine states — Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Virginia — and the District of Columbia signalled their intention to adopt the auto emissions standards of the California Air Resources Board (CARB). These standards are considerably stricter than those laid down for the nation by the recent Clean Air Act. Since this date, Rhode Island has also opted for California standards.

The primary motivation behind this move is ozone pollution. The Clean Air Act of 1990 required the Environment Protection Agency (EPA) to classify states as 'attainment' or 'nonattainment' areas with regard to meeting federal air quality standards for emissions of ozone, carbon monoxide, nitrogen oxide, sulphur dioxide, lead, particulate matter, and volatile organic compounds (VOCs). All nonattainment states are required to take measures to meet specified standards over a time period which depends on how far they are away from attainment. A marginal nonattainment state, for instance, will have 3 years to meet standards, and a moderate nonattainment state, 6 years. In both cases, the state must meet milestones along the way that demonstrate continuing progress. States, however, are allowed leeway in choosing what measures they will adopt to reach attainment status, and one of the options allowed them by the Clean Air Act (Section 249 (f)) is the adoption of stringent California auto emission standards.

Emissions of ozone are a problem in the northeast because they tend to migrate up the coast, especially in summer. Maine, for instance, acquires emissions generated in Massachusetts which, in turn, acquires those generated in Northern Virginia. Recognising this fact, the Clean Air Act (Section 184 (a)) mandated the formation of an organisation of all states northward from Virginia to Maine, and as far west as Pennsylvania, to deal jointly with ozone emissions. The resulting Northeast Regional Ozone Transport Commission, composed of representatives appointed by state governors, contains states that are all classified as ozone nonattainment areas except for Vermont, which did not sign the October agreement. The only other member state not to sign was Connecticut, which announced that it intended to focus on other types of measures to reduce its ozone emissions. Texas and Illinois are also considering adopting California auto emission standards. If they do so, it will mean that some 45 percent of the US auto market is pledged to meet California auto emission standards.

Environmental pressures

It was noted at the recent annual convention of the American Petroleum Industry that environmental issues had replaced security in the energy debate. Proof of this statement, if needed, was the Senate's refusal to consider the Administration's energy bill early in November last year in the face of an environmentalist campaign opposing the bill's proposal for drilling for oil in the Arctic National Wildlife Reserve (ANWR) in Alaska. Whether this Administration will see the passage of an energy bill is now in doubt. The House of Representatives still plans to consider a bill early in 1992 which does not call for ANWR drilling, but President Bush has said he will veto any bill which does not include ANWR exploration.

In the absence of energy legislation, one of the major government influences on the oil industry is the Clean Air Act whose implementation, administration, and enforcement is in the hands of the EPA. The promulgation of a regulation by the EPA to implement the Act's decrees is a slow, complex process. It must be done in accordance with the 'sunshine' provisions of the 1966 Administrative Procedures Act, designed to insure fair process and public access, so that everything that goes into the making of a regulation is on the public record. An EPA proposed regulation is reviewed, for instance, by the executive Office of Information and Regulatory Affairs. Another controversial review body, as it has no statutory mandated responsibilities, is the Council on Competitiveness, chaired by Vice President Quayle, set up in 1989 to 'ensure that federal regulations do not place unnecessary burdens on business and that the benefits outweigh the costs'. In the implementation of the Clean Air Act, as well as in the Congress, other industries often lobby for environmental regulations which could hurt the oil industry.

State actions

The EPA's decision to monitor and classify airborne pollution by geographic areas has given considerable political power over regulatory decisions to state governments which are, in their turn, influenced by each state's industrial interests. More stringent auto emissions regulations, for instance, can help a state comply with air quality requirements without enacting stringent pollution laws targeting its industries. Recently, one state politician, arguing for the adoption of

California auto emission standards

Four categories of vehicles certified to increasingly stringent emission standards will be permitted in California over the next decade by the California Air Resources Board (CARB): Transitional Low Emission Vehicles (TLEVs), Low Emission Vehicles (LEVs), Ultra-low Emission Vehicles (ULEVs) and Zero Emission Vehicles (ZEVs). Vehicle manufacturers, beginning in model year 1994, will be allowed to meet progressively more stringent average standards with any combination of TLEV, LEV, ULEV, ZEV, or conventional standard vehicles, so long as their fleetwide emissions do not exceed the prescribed average in any year.

The CARB specifies that hydrocarbon exhaust emissions between 1994 and 1996 should be no more than 0.125 grams per mile for 10 percent to 20 percent of new cars in the state. By 1997, at least 25 percent of all new cars will have to meet a hydrocarbon emission standard of 0.075 gpm and a nitrogen oxide emissions standard of 0.2 gpm. In 1997, at least 2 percent of all new cars can have no more than 0.04 gpm of hydrocarbon emissions. By the year 2000, 96 percent of all new cars sold in the state will have to be LEVs; no cars with less than 0.075 gpm hydrocarbon emissions will be allowed. By the year 2003, one-tenth of all cars sold will be LEVs.

California auto emission standards, noted that the alternative would be 'draconian' restrictions on state businesses.

The decisions by northeastern states to adopt California auto emission standards will not be final until these have been through a state regulatory hearing process. In some instances, although not required by federal law to do so, states will request their legislatures' approval. The oil industry is urging these states, and others, to avoid auto emission standards written to meet the unique, extreme air pollution problems of southern California. A joint task force of 14 major oil companies and the big three US auto makers are pressing states to mandate, as alternatives to California auto emission standards, measures to reduce gasoline vapour pressure at service stations, such as accordion-shaped pump nozzles and pollution control hardware, such as preheated catalysts that reduce emissions from cold engine starts. In addition, they are urging incentives for the retirement of older, heavily polluting cars and effective state inspection and maintenance laws to reduce emissions from poorly maintained cars. The EPA recently suggested that there were major flaws in one state's car emission inspections and suggested that state, and others, should try harder to reduce pollution from cars now on the road 'before turning their attention to exotic new technologies such as cars that meet California emission standards'.

Reformulated gasolines

The Clean Air Act required the sale of reformulated gasolines, by 1995, in 9 targeted metropolitan areas which collectively consume nearly 25 percent of the nation's gasoline producton. All ozone nonattainment states, such as those in the Northeast Regional Ozone Transport group, can request inclusion in the reformulated gasoline target area if they wish and Rhode Island has already done so.

The EPA intends to allow refiners, blenders and importers to meet reformulated gasoline performance standards through a variety of formulas. Reformulated gasolines for targeted areas must contain at least 2 percent oxygen, no more than 1 percent benzene and no heavy materials such as lead. The toxic and volatile organic compounds must be reduced by 15 percent by 1992, and by 25 percent by 2000, compared with baseline 1990 gasolines.

An EPA draft proposal for a reformulated gasoline rule was presented in August to representatives of 30 interested parties, including oil companies, auto companies and environmental groups, which then met and negotiated a draft agreement. This was sent out to participants in the so-called 'regneg' group for comments. The EPA hopes to publish its proposed reformulated gasoline rule this month and to have a final version in several months. The rule will describe the model the EPA has developed to determine the emission effect of reformulated gasolines by relating fuel parameters to emission rates, relative to the baseline of representative 1990 model year vehicles. It will also describe the EPA procedures to broaden the model if refiners come up with new fuel parameters. In addition, the rule will elaborate EPA enforcement measures, which will include sampling fuels produced by every refiner, blender and importer, as well as monitoring fuels sold in different states.

California, in the meantime, plans to set more stringent requirements than those laid down by the EPA for reformulated gasolines sold in the state after 1996.

Costs to refiners

The industry changes necessary to produce reformulated gasolines are considerable and huge investments will be needed to retrofit plants and distribution systems. It has been suggested that the economic burden will be too heavy for refiners now barely breaking even, especially those with old plants. It has also been suggested that some foreign refiners which are currently exporting to the United States will be unwilling or unable to make the investments necessary to produce reformulated gasolines. ■

Ford introduces fast warm-up system for catalysts

Ford has scored a world first with a new system to reduce cold-start exhaust emissions dramatically by bringing a vehicle's catalyst up to full operating temperature in seconds rather than minutes.

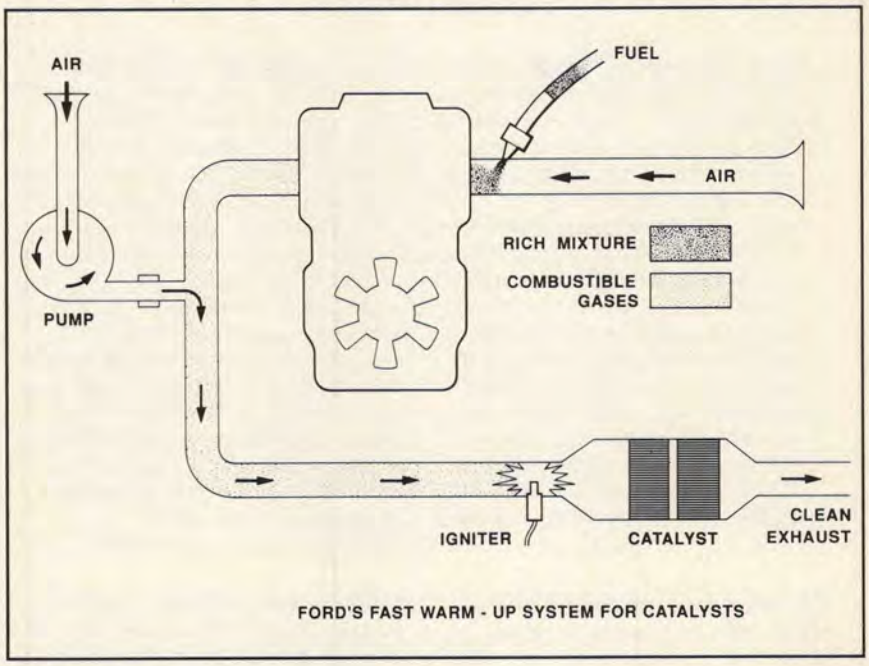
With the new system Ford is able to reduce — by 80 percent — the amount of unburnt hydrocarbons and carbon monoxide emissions produced by a catalyst-equipped vehicle during its warm-up period.

Extensive testing has shown that reliable and consistent 'light-off' of the catalyst is achieved within a few seconds following a cold start. This is effective for all start-up conditions.

The new concept is the result of long-standing collaboration between engineers at Ford and Cambridge University. Dr Tom Ma, Technical Specialist at Ford's Research and Engineering Centre at Dunton, Essex, and Dr Nick Collings, Lecturer at Cambridge University's Engineering Department, have developed a simple method of 'firing-up' a catalytic converter to make it active in a fraction of the time normally taken by an engine's exhaust gases to bring it to operating temperature.

Called EGI (Exhaust Gas Ignition) the Ford method involves heating the catalyst by briefly igniting a measured mixture of fuel and air in the exhaust system in an afterburner just ahead of the catalyst.

Fuel to the afterburner is delivered using the exhaust gases from the engine which is calibrated to run rich, while air to the afterburner is supplied by an electrically-driven air pump.



FORD'S FAST WARM - UP SYSTEM FOR CATALYSTS

The catalyst is heated to above 350°C — the level at which it becomes active — by igniting a controlled concentration of hydrogen which is produced within the engine's exhaust gases. As hydrogen is easily ignitable, it fires up the afterburner instantly as soon as the engine is started. The heat output from the afterburner is in the order of 7,000 watts, which is sufficient to light off the catalyst within a few seconds.

'The improvement in warm-up time is significant because the catalyst normally takes a long time to reach its operating temperature,' said Dr Ma. 'During this period the emissions produced by the engine are untreated . . . . As much as 80 percent of the exhaust emissions in a short journey are produced during the first two minutes from start, when the catalyst is warming up.'

The impact of the new system in helping to reduce the motor vehicle air pollution will be significant.

The Ford system could become available within the next three years.

New gas to methanol catalyst

Researchers at the University of New South Wales in Sydney have patented an improved catalyst for converting natural gas into methanol, which can then be used as a low-polluting transport fuel.

The University of New South Wales scientists are claiming a 100 percent improvement over the best refinery converters now in use.

Tests on the catalyst are being carried out in Germany and the Australian group is now looking for local industrial partners that will take the project into the next phase of development preparatory to large-scale production.

The breakthrough is the result of more than 12 years research by a team of three from the University's school of chemical engineering and industrial chemistry — Professor Mark Wainwright, Professor David Young and more recently Dr Edward Curry-Hyde.

Their catalyst is produced from copper, zinc and aluminium, using a novel technique that has earned the university's commercial arm, Unisearch, international patents.

They emphasised the importance of methanol internationally because of its potential as a raw material. These include high performance plastics, animal feed additives and standard transport fuel. Trials in the United States and Germany have shown methanol to be a better environmental alternative to petrol for transport, Dr Curry-Hyde said. 'And there is already a very big market — and growing'.

In the United States the pressure was on to use more methanol and methanol-petrol mixes in cities such as Los Angeles and San Francisco, because of their cleaner burning properties and small contribution to photo-chemical smog.

RS Components has launched two new safety torches and a handlamp, all of which are certified for use in potentially explosive atmospheres.

Manufactured by The Wolf Safety Lamp Co, the torches and handlamp conform to harmonised European standards.

Oxygenate production increased

Enhanced refining technology now available from Phillips Petroleum Company can convert very high percentages of isobutylene and reactive isoamylene into methyl tertiary butyl ether (MTBE) and tertiary amyl methyl ether (TAME) respectively, helping refiners meet Clean Air Act requirements for gasoline.

The updated etherification process can convert more than 91 percent of reactive isoamylene to TAME, which is added to gasoline to increase oxygen levels, allowing it to burn cleaner. Other conventional processes convert only about 70 percent of reactive isoamylenes into TAME.

The technology also can convert more than 99 percent of available isobutylene to the oxygenate MTBE, compared with 96 percent conversion by the current technology, according to Gary Patton of Phillips Petroleum Licensing Division. When used with the Phillips Petroleum STAR (STeam Active Reforming) Process, the improved technology results in increased overall butane utilisation in MTBE production.

'The enhanced oxygenate conversion process is an extension of technology which Phillips Petroleum now uses in its own refineries and licenses to other refiners worldwide,' Mr Patton said.

The simple, easy-to-maintain process uses existing refinery facilities — including conventional down-flow fixed-bed reactors — thus avoiding the special equipment associated with catalytic distillation units.

Novel self-lubricating swivel joint

British Technology Group is to commercialise a novel self-lubricating swivel joint for the oil industry. Developed by J H Fenner & Co Ltd, this swivel joint incorporates high pressure pipe joint technology. BTG has been licensed the design rights, know-how and patents to the technology, outside Europe, and is actively seeking companies interested in manufacturing and/or selling it.

As the majority of new oil fields are smaller and oil exploration is taking place in deeper water, subsea completion systems have been developed for greater efficiency. These systems are located on the sea bed and need to be connected by flowlines either to fixed or floating production platforms or to a tanker. For maximum flexibility, a swivel joint is needed which can withstand high pressures and temperatures, and high external loads.

A clean and safe work environment and fast mixing are benefits claimed for an automated closed system for dosing drilling-mud additives, designed by Procon Engineering of Asker, Norway.

The Procon Chemical Dosing System, turning a heavy, health-hazardous and inaccurate work into a clean and efficient operation, is based on three innovations: closed, dustproof and watertight chemicals containers, rotating feeders able to feed out any material with precision, and electronic weighing.

Ethylbenzene unit

Badger, a Raytheon company, has announced the successful start-up of Shell UK Limited's unit to produce 160,000 million tons per annum of ethylbenzene by the Mobil/Badger Ethylbenzene Process. The facility is located in Shell's Stanlow manufacturing complex. It is the first commercial installation of this process to use dilute ethylene as the feedstock. The design of the plant was executed in Badger's office in The Hague.

Tail gas from Shell's residue cat cracker is used as feedstock after removal of heavy components only. Because of the ruggedness of the Mobil ZSM-5 catalyst, no other pretreatment steps are necessary. All non-olefins in the feedstock pass through the process as inerts and are used as refinery fuel.

The plant was started up and all performance guarantees were demonstrated within two weeks. Conversion of the ethylene in the feedgas was essentially complete. Yields and product purity are equivalent to those obtained in conventional ethylbenzene units fed with polymer-grade ethylene.

The process achieves a significant economical upgrade of the value of ethylene in dilute refinery streams. Using FCC tail gas as feedstock reduces the variable cost of ethylbenzene production by over US$0.05 per pound at today's energy prices.

Badger has designed two other plants utilising dilute ethylene feedstock. The first of these will start up in Europe this year.

Radio tags

Senior Davis Derby, a division of Senior Control Equipment Limited, has announced its appointment by Texas Instruments to provide systems based on the Texas Instruments Radio Identification System (TIRIS), for use in hazardous atmospheres.

The TIRIS system uses miniature passive radio transponders, each of which carries a unique 64-bit (20-digit) identification code. When the transponder — which does not require any power source — is introduced into the field from a low-power, pulsed radio frequency (r.f.) aerial, it uses the received energy to transmit its identification code to an r.f. reader unit. The transponders typically have an operational range of up to 1 metre from the aerial.

Mobile laboratory

Lloyd's Register has taken delivery of a fully mobile air pollution laboratory, the first in the United Kingdom, and one of the most technologically advanced of its kind in the world.

The laboratory, supplied by Horiba Instruments Ltd (UK) and manufactured in Germany by its sister company, can run for up to 16 hours without mains power, enabling Lloyd's Register to measure major air pollutants, assess air quality and identify and evaluate pollution sources on a number of sites in a single day. The on-board power supply also means that Lloyd's Register can respond rapidly to air pollution incidents and in most cases will be able to start monitoring immediately on arrival at site.

The laboratory is equipped with six air pollution analysers. Five of these measure gaseous components: SO_2, CO, O_3, NO_x, CH_4/non-CH_4 hydrocarbons. The laboratory also has a particulate monitor which enables real-time measurement of particulate levels. This is supplemented by meteorological measuring equipment which can assess wind speed and direction, ambient temperature, relative humidity and rainfall.

The first application for the mobile laboratory will be a study for the Department of Transport to look at ventilation and air quality on ro-ro ferries.

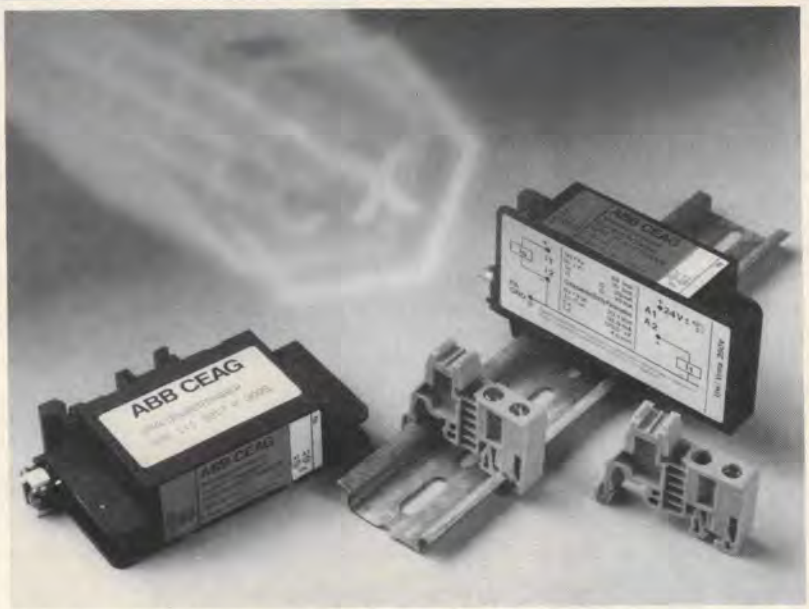
The laboratory will then be used to conduct a series of pollution measurements in two major ports as part of Phase II of the Marine Exhaust Emissions Research programme.

The versatile nature of the laboratory means that it can be used for a wide range of projects. It will be useful to local and national authorities that require investigations into air pollution under the requirements of the Environmental Protection Act 1990 and forthcoming EC Directives that come into this area. It will also be used to carry out environmental impact assessments.

Oxygen analyser

Teledyne's economical Model 9600 Oxygen Analyser System provides continuous monitoring of flue gas for improved combustion efficiency and reduced exhaust emissions. The Model 9600 is ideal for use with boilers, furnaces and process heaters that are fired with such clean fuels as natural gas and low-sulphur fuel oils.

It uses a simple sample system centred around a highly reliable air aspirator. The system automatically and continuously conditions flue gas for accurate analysis. It is compact, easy to install and easy to use.



Hazardous area transmitters, of the type used to measure parameters such as temperature, pressure and flow rates, have always been dependent upon the efficiency of their power supply unit. Traditionally there have been two alternative approaches — relatively low-cost zener barriers which require complex engineering calculations to ensure that the feed supply is sufficient to power the transmitter or the more sophisticated, but significantly more expensive, galvanic solution.

Now ABB Control has developed a range of transmitter power supply units which ensure a constant 15V supply voltage to the transmitter at half the cost of the galvanic option.

Global Met Office

The Met. Office is poised to take its offshore oil expertise to the world. The move coincides with new supercomputers and software which can produce a forecast for any set of latitude and longitude coordinates.

Already, overseas location work has included the Norwegian and Dutch sectors of the North Sea and the Gulf of Cadiz. Initial target areas for the first overseas drive will include the Far East, African coast, Australasia and the Gulf of Mexico.

In time, the extra revenue is expected to earn Britain £1–2 million annually, building on the current £1.3 million already generated by the offshore unit.

The developments are part of an upgrading of service from the Aberdeen-based team, including MIST, the new Meteorological Information Self-briefing Terminal, offering up-to-the-minute weather information for offshore operators by personal computer. A dial-up service is expected in the New Year.

The global forecasting improvements stem from a new-generation supercomputer 'model' at the Met. Office headquarters in Bracknell.

North Morecambe

John Brown, a member of the Engineering Division of Trafalgar House, has been awarded by British Gas Exploration & Production Limited a contract worth £16 million for the detailed engineering and procurement of the North Morecambe onshore terminal. The contract also covers the supply of support services to the construction site and fabrication yards, to meet British Gas' requirements.

The terminal will handle the gas produced from the North Morecambe Field (Block 110/2d) in the Irish Sea.

Contact List

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Lloyd's Register	**071 709 9166**
British Safety Council	**081 741 1231**
Teledyne	**081 571 9596**
British Technology Group	**071 403 6666**
ABB Control	**0203 368 500**
John Brown	**071 262 8080**
Badger, Cambridge, USA	**617 494 7713**
RS Components	**0536 201 234**
Procon Engineering, Norway	**2-78 91 65**
Met Office	**0344 856 655**
Senior Control	**0332 294 212**

Certified calibrant for IP 336 'Determination of sulphur — energy dispersive x-ray fluorescence method'

The Laboratory of the Government Chemist (LGC) is starting work on the production of batches of n-dibutyl sulphide with a certified sulphur content for use in the above method and ISO 8754.

LGC are looking for laboratories who can assist in this work by carrying out sulphur content determinations on samples of n-dibutyl sulphide using the IP 61 'Determination of sulphur — Bomb method'.

Alan Traynor of LGC is coordinating the work and will be pleased to hear from as many laboratories as possible. Alan may be contacted at Department of Industry, Laboratory of the Government Chemist, Queens Road, Teddington, Middlesex TW11 0IY. Fax (081) 943 2767.

British Standards

Two draft ISO test methods have been issued as draft British Standards for public comment:

'Method for determination of ash in petroleum products' (≡ISO/DIS 6245), a revision of ISO 6245:1982.

'Method for determination of aluminium and silicon content as estimate of catalyst fines in fuel oils' (≡ISO/DIS 10478), a new British Standard.

IP 40/BS 2000: Part 40 'Oxidation stability of gasoline (induction period method)'

As was mentioned in the September issue of *Petroleum Review* the apparatus specified in IP 40 has been amended with regard to safety concerns to include a burst-disc. IP 40 is also part of the British Standards 2000 series as BS 2000: Part 40:1991. It was therefore thought prudent to revise the British Standard immediately to bring it in line with the revised IP method. BS 2000: Part 40: 1992 has been issued as a draft British Standard for public comment.

Closing date for observations on drafts for public comment

All comments on these drafts should be sent to Miss P D Higgs, Secretary to PTC/13 at the Institute of Petroleum by 31 January 1992.

IP 345 'Determination of composition of associated natural gas — gas chromatography method'

At a recent meeting of sub-committee ST-G Analysis the future of the above method was discussed.

The method does not have a precision statement and if it is to be retained will require revising to meet current IP method format.

ST-G would like to hear from people who analyse associated gas to ascertain the following:

1) Whether they use IP 345 or ASTM D 2597?
2) Is IP 345 still required?
3) Should the IP approach ASTM with a view to having a joint IP/ASTM method based on D2597?

Replies should be sent to the IP for the attention of John Phipps, Technical Department.

New Chairman for Sub-Committee ST-G Analysis

At the November meeting of ST-G Roger Amos announced his forthcoming retirement. Bob Hooks was proposed and unanimously elected as the new chairman and will take office in April 1992.

Institute News

UKOOA updates the IP Shetland Branch on progress

The Institute of Petroleum (Shetland Branch) celebrated its Annual Dinner on 1 November. Following the dinner, the Branch Chairman, Captain Jeremy Procter, introduced the Guest of Honour, Dr Harold Hughes OBE, Director General of the UK Offshore Operators Association. Dr Hughes provided an update on the development and work of offshore safety committees. He went on to criticise remarks made by Mrs Winifred Ewing, MEP for the Highlands and Islands, in her references to new safety legislation being introduced by the European Community.

Dr Hughes said: 'Many platforms had safety committees before the Piper Alpha tragedy; they are all now fully in being on all platforms and rigs in UK waters. Our recent survey showed that 1,000 safety representatives have been freely elected to those committees by their workforce colleagues. The committees meet on average at twice the frequency laid down in the legislation. With the active involvement of company top managements, both offshore and on the beach, they are proving to be very effective in encouraging two-way flow of safety information, discussions and decisions.'

He went on to comment on Mrs Ewing's claims that safety representatives were being blacklisted or stood the chance of being victimised. He said: 'I reject completely and unequivocally such allegations. I invite her to come offshore with me and meet the workforce (if she wishes, in private conversation) and make her judgements on fact — not hearsay. What she will discover is that every worker has the right to elect and be elected as safety representative, by secret ballot if there is more than one candidate, and by defined constituencies. Representatives are trained to standards laid down by the Offshore Petroleum Industry Training Organisation (a tri-partite body including trades unions and training providers). If victimisation were a threat, is it likely that 1,000 safety representatives, from oil company and contractor personnel, would be willing to serve their colleagues in this way? Mrs Ewing also referred to the formation of another offshore union (the OILC) as being 'out of the despair of the offshore workforce'. My own view is that the workforce are despairing of so-called spokesmen who seem quite out of touch with the position and unwilling to recognise that the workforce are already fully participating in the day-to-day task of ensuring safety offshore. Those who still try to say that the offshore workers have no say on safety are talking nonsense.'

Dr Hughes concluded his address by referring to the recent successful licensing round for areas west of Shetland, which would open up new areas for exploration. He said: 'It is going to be a long game — the licence areas are in very deep water but the technology exists. The critical factor in development will be the international oil price, something we here really cannot do much about. But UKOOA has not changed its view from that set out in its 1989 Technical Study, which forecast a further 100–300 new fields for the North Sea — and that forecast did not even take into account the area west of Shetland. The United Kingdom will maintain its oil self-sufficiency into the next century and there will still be a strong active industry 25 years out. What other industry in the United Kingdom can look ahead to such a confident future? It continues to offer very good career prospects to those within it.'

Dr Hughes OBE, centre second row from back, Captain J Procter, Branch Chairman, on his right with members and guests at the dinner.

New Fellows

Mr RM Elliott, Vice President, Chevron International Oil Co Inc.

Vice President and Regional Coordinator for Europe, Africa and the Middle East. Mr Elliott has been employed by Chevron International Oil Co Inc since 1985. Prior to Chevron, he had various management positions at Gulf Oil from 1977 to 1985 and was also in Finance/Supply at Total/CFP from 1968 to 1972. During the years 1972 to 1977, he was a Petroleum Consultant at Booz-Allen & Hamilton Inc. Mr Elliott is also a Fellow of the Institute of Cost and Management Accountants.

Mr NC Chambers, Chief Executive Officer, Rockwater.

From 1973 to 1985 Mr Chambers was employed by Sub Sea Offshore Ltd, becoming Commercial Manager, responsible for Europe in 1982. He was then President of the Western Hemisphere Division for Taylor Diving Inc, 1985 to 1988. He served at Wharton Williams Taylor, as Managing Director of worldwide activities, for two years. Mr Chambers then joined Rockwater in 1990 being responsible for Rockwater's worldwide underwater construction and maintenance activities and also direction and strategy for their worldwide business. He is Chairman of the Association of International Underwater Engineering Contractors.

Mr RW Hastings-Dasent, Managing Director, Repsol UK Ltd.

Mr Dasent joined Petrofina (UK) Ltd at the age of 16, staying with the company for 32 years. He was appointed Director in 1986, and also sat on the Boards of Lindsey Oil Refinery, Associated Petroleum Terminals and Lanfina Bitumen Ltd. In 1990 Mr Dasent joined Repsol as head of their UK operations, which includes the Chairmanship of Carless Refining and Marketing and Repsol Petroleum Limited.

Mr GJ Hearne, Chairman/Chief Executive, Enterprise Oil

After practising as a qualified solicitor for a number of years, Mr Hearne joined the oil industry in 1981 as Chief Executive for Tricentrol. He then became Managing Director of Carless, Capel & Leonard, from 1983 to 1984, and moved on to be Chairman at Brindex 1986 to 1988. Mr Hearne was a part-time member of BNOC, 1975 to 1978, and has been a member of Council at UKOOA since 1985. He is a Member of the Society of Petroleum Engineers and a Fellow of the Royal Society of the Arts. Mr Hearne was awarded a CBE in June 1990.

Mr Hubert W Knoche, Managing Director, Elf Oil (GB) Ltd.

Mr Knoche has been employed in the oil industry since 1968 when he started his career with Elf in the Research & Development Division. In 1976 he became Director of Research & Development in the Refining & Marketing Branch of Elf. In 1981 he was nominated Manager of the Feyzin Refinery, near Lyons, where he stayed until 1988 at which time he became Director of Elf's Refining & Marketing activities in Europe (outside France).

Mr Knoche holds a PhD in Chemistry, which he attained at the Technische Hochschule in Karlsruhe, Germany, after studying chemistry and chemical engineering. Mr Knoche is also a Member of the Association Française Technique du Pétrole.

Deaths

We report with much regret the deaths of the following members:

	Born
R F Aungier, (Member of IP Committee PMA-2), Hailsham, Sussex	1939
P J Garner, Birmingham	1911
B A Lascelles, London	1944
W F C Mackie, Godalming, Surrey	1905
J C Raine, Consett, County Durham	1914
D Warren, Betchworth, Surrey	1938

Around the Branches

Aberdeen
14 January: 'The Work of the Offshore Chaplain', Reverend Andrew Wylie, Scottish Churches Industrial Mission.

Edinburgh and South East Scotland
16 January: 'Heavy Metal Reverberates to Cultural Change', Mr R Taylor, Chairman, The Taylor Group.

Essex
8 January: 'The Role of the Independent Inspection Company', Mr AH Edwards, AH Edwards Consultants Ltd.

Humber
23 January: 'Refinery Construction and Maintenance', by Fluor Daniels.

London
14 January: 'Direct Gas Marketing', Mr FP Cooke, Quadrant Gas.

Malta
28–31 January: 'Mediterranean Oil and Gas Exhibition' co-sponsored by IP Malta Branch.

Midlands
22 January: 'Recycling Processes', Mr DJ Neadle, Smallman Lubricants.

Northern
14 January: 'Drilling Muds', Mr R Gough, AKZO.

Southern
22 January: 'Patents Office'.

Stanlow
22 January: AGM followed by 'European Market Related Topic', Mr JA Perry, BP Oil (Europe).

Shetland
18 February: AGM.

South Wales
21 January: 'Explosives Awareness', Mr K Callaghan, MOD.

West of Scotland
6 March: Petroleum Dinner.

Yorkshire
14 January: 'Running a Railway', Mr DJ Knight, Area Manager, British Rail.

Deliveries into Consumption

UK deliveries into inland consumption of major petroleum products — Tonnes — October 1991

Products	*Oct 1990†*	*Oct 1991**	*Jan–Oct 1990†*	*Jan–Oct 1991**	*% change*
Naphtha/LDF	189,570	270,310	2,519,120	2,733,250	9
ATF—Kerosine	562,860	559,470	5,646,470	5,212,370	−8
Motor Spirit	2,040,790	2,083,750	20,338,030	20,026,490	−2
of which unleaded	766,990	896,250	6,769,300	8,143,830	20
Super unleaded	84,200	108,800	759,060	963,310	27
Premium unleaded	682,790	787,450	6,010,240	7,180,520	19
Burning Oil	117,930	223,370	1,610,630	1,882,990	17
Derv Fuel	906,270	986,980	8,906,750	8,929,360	0
Gas/Diesel Oil	625,670	676,370	6,609,630	6,636,380	0
Fuel Oil	628,970	904,910	10,590,227	10,194,010	−4
Lubricating Oil	77,733	71,530	702,933	641,440	−9
Other Products	513,107	596,210	5,142,620	5,478,190	7
Total above	5,662,900	6,372,900	61,843,050	61,734,480	0
Refinery Consumption	420,490	517,710	4,828,100	5,041,210	4
Total all products	6,083,390	6,890,610	66,671,150	66,775,690	0

†Revised *Preliminary

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Textron Speciality Materials has promoted **Mr John Dunk**, above, to Director of European Sales and Marketing. Mr Dunk will be responsible for the company's business development, marketing and service activities in Europe.

The annual Royal Society Esso Energy Award has been presented to **Dr Frank Fitzgerald CBE, F.Eng,** of British Steel plc for his contributions in improving the energy efficiency of British Steel resulting in a subsequent reduction in costs following the energy crisis which occurred during 1974 and 1979. Since 1980 British Steel's energy costs have fallen from 20 percent to 11 percent of total costs and energy consumption per tonne of liquid steel produced has fallen by 26 percent.

Moore Products, the process instrumentation and control equipment company, has appointed **Mr Graeme Quigley** to head its subsidiaries in the United Kingdom, France, Italy and The Netherlands. As the new President of Moore Products Co Europe, Mr Quigley will be responsible for expanding customer services and company sales of process control hardware and software throughout Europe.

Dr Ian Berwick, Director General of the UK Petroleum Industry Association since 1984, has retired and is succeeded by **Mr David Parker.** Mr Parker has over 30 years experience in the oil business with Shell International in various overseas locations and the United Kingdom. His posts have included senior general management in operating companies and a wide range of commercial assignments, principally in supply and corporate planning.

Offshore survey company Geoteam UK Ltd has made two senior appointments at its Aberdeen headquarters. **Mr Chris Mott** and **Mr Allan Kirby** have been appointed to the newly created posts of Marketing and Business Development Manager and Quality Assurance and Safety Supervisor, respectively. Mr Mott worked most recently as a consulting geophysicist. Mr Kirby joins the company from Brown & Root Marine UK, where he was Project Manager responsible for offshore survey support contracts.

Aberdeen Service Co, the oil services subsidiary of the Sidlaw Group plc, have promoted **Mr Colin Manderson**, above left, who has been Operations Director of their offshore supply bases at Peterhead and Aberdeen to General Manager of UK operations. At the same time, **Mr David Maitland**, above right, joins the company as Financial Director after seven years with BP Exploration, where his most recent post gave him overall responsibility for management information and group accounting for BP's North Sea operations.

The Norwich based storage tank and chimney fabricators EG Reeve and Sons have appointed **Mr Roy Haddock** as Senior Estimator to run their sales department. Mr Haddock has 13 years engineering experience principally in oil/effluent storage.

Mr Peter Sanguinetti currently Director of Corporate Communications BAA has been appointed as Director of Corporate Affairs, British Gas plc. Mr Sanguinetti was appointed Director of Public Affairs at the former British Airports Authority in 1983. After privatisation he became Director of Corporate Communications of BAA covering investor relations, press relations, parliamentary affairs in the United Kingdom, United States and EEC as well as corporate advertising and co-ordination of communication throughout the group. In his new position at British Gas he will report direct to **Mr CE Donovan**, Senior Managing Director.

IP appointment

Roger Sparrow joined the Institute of Petroleum on 2 December as Membership Services Director. His previous post was Marketing Manager with the British Pipeline Agency Ltd. After graduating from Oxford, he spent the early years of his career in sales and marketing with Shell Mex and BP Ltd before moving to the British Pipeline Agency in 1975.

The RGIT Survival Centre has announced two senior management appointments. **Mr Andrew Avery** is promoted from Marketing Manager to Business Development Manager. The Centre's Medical Services Manager, **Dr John Brebner,** has been named as the new Operations Manager.

The Managing Director of the Centre, **Mr Joe Cross**, above, has been awarded an Honorary Degree of Master of Science by The Robert Gordon Institute of Technology in recognition of his outstanding contribution to survival training for the North Sea offshore oil industry. Mr Cross has been Managing Director of the RGIT Survival Centre for 17 years. The Centre trains more than 22,000 offshore workers every year.

Mr EL Shannon Jr has been elected a Director of McDermott International Inc. Mr Shannon is Chairman of the Board of Santa Fe International Corporation, an offshore and onshore international drilling contractor and a US oil and gas exploration and production company.

Mr Peter Groen has been appointed as General Manager Petroleum Consultants in PT Qualitech Perdana, Jakarta, a recently established joint venture between SGS and Sucofindo. Mr Groen was previously Vice President SGS Inc, Japan.

Coplex Resources NL, the Australian quoted company, have appointed **Mr WE Richardson** as a Director. Mr Richardson, who has over 40 years international oil industry experience, will manage Coplex's US interests.

CONSULTANT LIST

Members of the Institute of Petroleum offer consultancy services in a wide range of petroleum industry subjects. A list of consultants in any category will be provided free of charge on application. Currently about 300 members offer 44 different categories within which we can identify other areas of expertise.

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

(Requests for lists of more than two categories may involve an administrative charge)

Anyone interested in obtaining this list should contact
Jo Howard-Buxton at the IP. Tel: 071 636 1004