In Brief...
GAS PROCESSORS ASSOCIATION EUROPE
Vol 24 Issue 1 February 2008

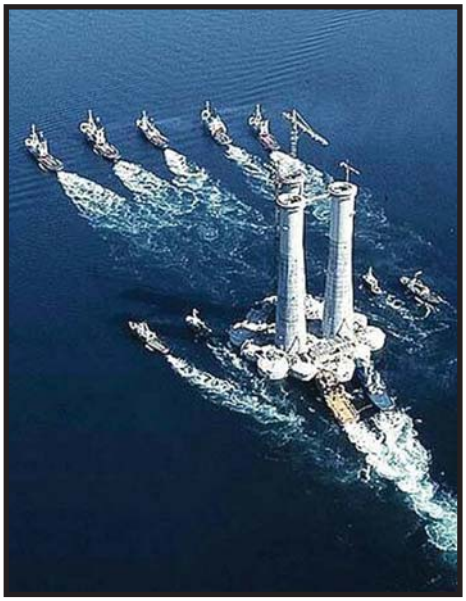
GPAE 25th ANNIVERSARY

The Past, Present and Future of the World of Gas Processing

2008 marks the 25th anniversary of the European Chapter of the Gas Processors' Association (the GPA). From its lusty origins as a twinkling in the eye of just four people, it has grown today to an organisation that sees over 400 people a year at its conferences and has provided over a thousand copies of its eponymous CD and handbook to the industry. As institutions go, at 25 years old the GPA is still a spring chicken. The Institution of Civil Engineers is 190 years old and even the parvenu Institution of Chemical Engineers is 85 years old! But that is not the point. For any institution to survive and prosper through a period of such radical change is an achievement worth celebrating. And celebrate we shall! Look out for the announcement of our **September Conference**. It will be in **Paris** – where the very first conference was held – and will be themed, looking at the **past, present and future of the world of gas processing**. Book early as the numbers are limited.

Let's just take a brief peek back at 1983. Tony Blair was a practising barrister and had yet to become an MP; Bill Clinton had been re-elected State Governor of Arkansas, and Monica Lewinsky was only 10 years old and unsuspecting of what history had in store for her. The Spice Girls were still in nappies and Mick Jagger was only 75 years old[1]; the Sinclair ZX81 was one of the best home computers that money could buy with 1 kB of RAM – slightly less than a current-day wrist watch. IBM was eyeing the personal computer market but needed to solve the minor problem of developing an operating system and was talking to Bill Gates about using his MS-DOS software. How they must rue that particular day. Hard though it is to believe, in 1983 nobody had heard of the spreadsheet, email or the BlackBerry and meetings used to be held without the aid of ClipArt or Power Point slides. What did they do with their time?

But just think what has happened to our industry since that time. Crude oil consumption has increased by 50% since 1983 and the price by a similar percentage. Oil production from the UK sector of the North Sea has grown from 1.5 million barrels per day (MMBPD) in 1982 to 1.5 MMBPD in 2007. Not much change there then! Apart from the obvious one that is. The world of LNG has changed more so: from a number of niche regional markets to a global and – almost – commodity market. Back then world LNG production was 22 mtpa: today it is 180 mtpa with lots more on the drawing board. Having talked about it for 80 years, converting gas to liquids on a major scale has left its South African home and ventured to Qatar and Nigeria. Who knows where next? That is the question we will have a crack at. Here comes the part where we become hostages to fate. As the wise man said, 'He who forecast the future is wrong, even when he is right!!'



Past: Statfjord A platform tow-out 1979
Photo courtesy of StatoilHydro

Present: Gas Processors take the challenge and go the extra mile. Photo courtesy of MW Kellogg

So what will be the major driving forces in the coming 25 years and what will our industry look like in the year 2033? The GPA Management Committee has been rash enough to put their heads on the block and their thoughts on paper: Mick Jagger will, of course, still be touring and England will still not have qualified for the World Cup but will have recognised that however much they pay their manager they are constrained by an inability to play football.

The GPA thinks that hydrocarbons are here to stay. In 2033 the Middle East and OPEC will be – more so than today – the source of much of the world's oil and increasingly its gas. Most of the world's oil will be in the hands of governments or their national oil companies. The independent oil companies will increasingly have to rely upon their wits to compete and will have successfully surmounted the technological boundaries in producing oil from ever deeper water, from colder climates, from more difficult reservoirs and in both a heavier and more sour form. The technological challenges are huge; the demand for human capital the most significant constraint. Expect this industry to adsorb some of the best engineering and scientific brains and to be a great place to work. Expect it to fight harder to train, recruit and retain its most precious resource.

The first onshore LNG liquefaction train in the world to be constructed in modular form. The biggest module, weighing 1,800 tonnes, being transported to the North West Shelf complex at Karratha in W. Australia. Photo Courtesy: Foster Wheeler/Woodside.

The big focus for the next 25 years will be **climate change and the reduction in greenhouse gas emissions**. The economist solution is a mechanism of carbon pricing and trading – but this requires the global collaboration and policing of the world's governments. As this has never happened in the world's 4.7 billion year history we don't think that it will be solved in 25 years. Action is both essential and inevitable though and the pressure for it will come from the streets with the more farsighted and open countries and companies taking the lead. The solutions are all there. There are no technological frontiers, just a real need to produce less CO_2 and to reduce the cost and to commercialise the integration of technologies to remove, transport and sequester green house gases.

Of course we are currently seeing the greatest surge in investment in our industry since longer than most people can remember. The shortage of commodities, materials, equipment but, above all, human capital is as great as it has ever been. The one thing we know for sure is that **bust follows boom**. The only question is when. At the GPA we believe we are sitting right now at the peak and that 2008 will see a downturn. On the one side driven by the turmoil in the financial community as the US subprime mortgage virus spreads; on the demand side by price inflation that will render some of today's ambitious capital investment plans uneconomic. However, we see but a small correction. China and India have become much more significant in terms of world economic growth and will become more so in the next 25 years, joined soon by Russia. In 1851 Horace Greely, editor of the New York Tribune, when looking at the next 25 years in the United Sates advised his readers 'Go West, young man, and grow up with the country'. For the young men and women entering the industry today and wondering where the future will lead them they would be well advised to reverse this quotation to 'Go East young wo(man) for there lies the new frontier'.

So where does this leave the GPA? We think more important than ever. The GPA is a not for profit industry body that exists to share best practice in the gas processing industries, to promote the industry to those considering their careers, and to provide an opportunity where the new and the more experienced can share their technical war stories and to learn from each other. Our industry has the answers to climate control, has the answers to difficult oil and gas, will continue to provide great careers for the best of the world's engineers and scientists and the GPA will continue to oil the wheels of a great and mighty machine.

Malcolm Harrison
Foster Wheeler Energy Limited
Reading, UK. 28 January 2008

1. Editor's note: Of course neither of these is true and each has been used solely for the purpose of gratuitous humour. The Spice Girls were 7 – 11 years old in 1983 and so highly unlikely to have been constrained by nappies. Mick Jagger was a sprightly 40.

View from the Top

A new year; new plans. Organisation of various events for this year is in progress, the first conference is in Amsterdam with our Spring Conference, 14-16th of May at the "Isle of Grain", where LNG issues will be discussed

2008 is a special year, since the GPAE will celebrate our 25th anniversary with a "Grand Spectacle" at our Annual Conference in Paris. It promises to be an exceptional event with several keynote speakers lined up from industry-leading companies, marking 25 years of GPAE history and providing a peek into the future of gas processing. The Conference will be preceded by a knowledge session and I recommend blocking 24-26th of September in your diaries.

It is my opinion that the GPAE has contributed significantly to the industry in Europe over the last 25 years and has established itself as an organisation that provides a platform for gas processors in Europe (and beyond).

Our events are maturing and becoming more professional every time. But we haven't lost our focus on providing a forum for all gas processors and encouraging the younger members to attend and/or present at our meetings. We also manage to keep our conference fees relatively low.

In terms of challenges for the future, there will be many technical issues to solve such as global warming, sour gas field developments, bio fuels; topics that have also got a huge social impact. It will, however, be a major challenge for the gas processing community to manage all that. In particular the pressure on the job market is felt by almost every company. It is a huge task to maintain a competent workforce to support the increasing work portfolio. I think this should be one of our top priorities for the next decade. In particular the influx of young gas processors into the industry is a matter close to our hearts. That is where the GPAE can contribute by helping to attract students.

We always welcome your suggestions or comments in this direction so that we can serve our members and the industry even better in the next 25 years.

I hope to see many of you at our events and I wish all of you a successful 2008.

Ed Bras (Chairman)
e-mail: ed.bras@shell.com

Knowledge Session, Bonn, Germany

SIL Assessment

The well attended knowledge session, IEC 61508, Safety Integrity Level (SIL) Assessment, was ably presented by Clive de Salis of Rowan House Ltd. Clive took us through the scope of what a SIL assessment should cover when an unacceptable risk is identified, how that risk can be reduced to an acceptable level, what level of risk reduction is needed and if further action is required. The level of risk reduction needed is expressed as factors of 10, from Non SIL requirement at a factor of less than 10, up to SIL 4 at a risk reduction value required of 10,000+.

The layers of protection available in the process design, through mechanical design, process control, passive safety devices and the various high level safety systems used in final defence were described. Clive detailed the engineering disciplines needed in the team to cover the various different layers contributing to the overall safety of the process.

Clive stressed the need for the use of good probability data from across the oil, gas and chemical industries

Clive de Salis
Presenter of the Knowledge Session in Bonn

to be gathered and used regarding process upset and equipment failures which can lead to catastrophic events. The various SIL assessment techniques, 2D Matrix, Layer of Protection Analysis (LOPA), Fault Tree Analysis and Risk graph, and the advantages and disadvantages of each were summarised. The 2D Matrix was described as too simplistic with a danger of generating an unrealistically high number of SIL loops. LOPA and fault tree need specialists for their application and are difficult to use in a team environment. The calibrated risk graph technique, if well designed and executed, was described as good for use in a team environment, particularly if the team consists mostly of people with good knowledge of the process, but who are not expert in IEC61508. Towards the end of the session, Clive conducted a group exercise in developing a calibrated risk graph.

One of the key messages which Clive gave was that if your process needs a large number of SIL loops, particularly high level, then you would be well advised to look at modifying your process in order to make it fundamentally safer. SIL is not a panacea for bad basic process design.

Thank you Clive, for an informative session delivered with expertise, enthusiasm and humour. The questions at the end showed that the attendees had been well stimulated.

David Healey

Annual Conference, Bonn, Germany

The morning session, chaired by Murtaza Khakoo of BP Exploration, presented five excellent papers covering all stages of gas processing plants; technology development and

Baard Kaasa

project execution phases through to commissioning and operations. The first paper by Baard Kaasa (co-authors Nicholas Marheim and Jesper Jacobsson) of Statoil entitled *Scale Removal from Condensate Stripper at Kollsnes Terminal,* discussed the investigation into scaling due to sodium bicarbonate salt (pH buffer) in MEG. Baard explained intriguingly how the soluble sodium bicarbonate salt ended up forming scale in a glycol settler tank as a result of good water-glycol separation in an upstream unit leading to his counter intuitive assertion that "good separation is not always optimum for the process". Baard proceeded to discuss how a "simple fix" of injecting neat, fresh MEG to wash the scale off now allows trouble free operation.

This was appropriately followed by the paper *Cooldown of an LNG Import Terminal,* presented by Bob Brannock (co-authors Andreas Hambuecker and Harry Isalski) from TGE Engineering, based on their experience at Reganosa Spain.

Bob Brannock

Annual Conference, Bonn, Germany

Arend Hoek

This discussed the techno-economic comparison made to determine whether to use imported nitrogen or LNG to cool down storage tanks and unloading lines. Bob provided a clear description of the two alternatives with advantages and disadvantages of each that could easily fit a good LNG text book. Eloquently describing the combination of factors including the economics, some site specifics, environmental, etc, the final solution adopted was a hybrid of using liquid nitrogen for the first phase of the cool-down followed by final cooling with LNG.

This was followed by three papers describing various phases of gas-to-liquids (GTL) development. The first, *Shell GTL Technology, Making it Happen*, by Arend Hoek of Shell, described how they built their GTL

Sharing ideas over coffee

technology portfolio from the learnings of 11 years of operation of the world's first GTL plant in Bintulu and the significant research and development in synthesis gas technology, Fischer-Tropsch conversion and hydro-conversion. Arend went on to describe their Pearl GTL project in Qatar quoting some awesome statistics to show the immensity of the project in terms of tonnage of steel, labour, energy requirements and plot area - as large as Hyde Park & Kensington Gardens together (2.5km^2)!

Foster Wheeler followed up with their technology paper, *A Floating GTL Solution for Stranded Gas*, which was presented by Peter Alderton (co-author Andy Hemingway). This described the concept for a combined oil processing and GTL unit on an FPSO and how they tackled some of the generic offshore issues - safety, layout, environmental, marinisation, etc.

Giving some truth that the best always comes last, the final paper by Alfonso Di Mario was presented by Giorgio Carretti of Technip Italy. The presentation, *The Oryx GTL Plant:*

Giorgio Carretti

The Contractor's Perspective, described yet another gigantic GTL plant that has recently been commissioned in Qatar. Giorgio provided some fascinating statistics for the mega-project in terms of the engineering - 600 P&IDs, 1,650 equipment pieces, 660 electric motors, etc; and construction 900,000m^3 of site prep, 1200km of cables, 8,600 loop checks, etc. Using some awesome pictures of the massive vessels and cranes, highlights from engineering, construction and start-up were provided.

In all, a good morning session of high quality papers gave plenty to discuss over the sumptuous lunch provided by the Bonn Hilton alongside the ideal conferencing and hotel facilities. *Murtaza A Khakoo*

Peter Alderton

Catching up with Europe

Annual Conference, Bonn, Germany

John Mak

Jonas Alin (left) and Chris Ness

The afternoon session included five papers, three of which covered aspects of CO_2 capture and re-injection. John Mak of Fluor in California presented *FLUOR Solvent Carbon Capture*. Economic imperatives are driving the development of gas reserves with high acid gas contents at reasonable pressures. John described the application of the FLUOR solvent process in 14 operating plants and included recent plant survey data for two of these. FLUOR solvent, which is the application of Propylene Carbonate as a physical solvent, is ideally suited to these high partial pressure CO_2 laden gases. The process regenerates the solvent by pressure reduction in stages as the absorbed gases flash off. The process leads to far lower utility consumption, notably there is no requirement for regenerator heating. John went on to describe the application of the FLUOR Solvent process to pre-combustion carbon capture in power generation applications and integration with the Syngas units.

David Weeks of MW Kellogg (co-author John Driscoll of BP) used his paper, *Processing considerations for carbon capture and storage,* to visit the fundamentals and practical aspects of CO_2 compression and conditioning prior to reinjection into the subsurface formation. In most instances, the CO_2 recovered from a natural gas stream is produced at low pressure and saturated with water. David recalled the specific characteristics of the carbon dioxide's water content and stressed that the actual injection system configuration and plant operation constraints shall be considered before making a decision on the drying system. Based on a case study, the importance of the correct modelling of the CO_2 stream characteristics was discussed, recalling to all of us that a critical look at the thermodynamic models used remains essential.

Christopher Ness (BR&E) and Jonas Alin (E.ON UK) co-presented the paper *Integration of Power Plant and process models for the simulation of coal fired power plant with post combustion CO^2 capture*. The paper presents the integrated model of an 800 MW coal-fired supercritical power plant design incorporating an MEA based CO_2 post-combustion capture.

Sets of correlations for the capture plant were derived that take into account the target rates of CO_2 capture, amine circulation flowrate and the various heat duties involved. The conclusion from this study is that the main capture plant effects on the efficiency of the power plant can be characterized by the stripper reboiler heat duty. A reduction of the overall plant efficiency from 45% to 35% is reported.

David Weeks

Not all questions are tough!

Annual Conference, Bonn

George Cheriyan

Manfred Ramdohr

George Cheriyan (co-authors William Mera, Vasiliy Malitsky, Alexander Elaev, Malcolm Smith and Andrey Medvedev) gave a fascinating paper, *TNK-BP - Marrying Two Facilities' Engineering Cultures* on the challenges of merging company cultures, covering both technical and regulatory aspects. TNK-BP is a vertically integrated company with upstream and downstream operations in Ukraine and Russia, created from the merging of BP's Russian oil and gas assets and oil and gas assets of the Alfa Group/Access Renova. Topics such as Russian standard design vs. Western tailor-made approach, use of P&IDs, Hazop and introduction of the Russian standards were used to illustrate the efforts deployed to reach a convergence between two deep engineering cultures.

As an introduction to the Siemens factory site visit, Manfred Ramdohr gave us some highlights on the evolution of compressor drivers. His paper, *Conceptual optimization of GT-driven compression trains for oil & gas upstream and midstream applications*, described improvements in the direct gas turbine drive, and the evolution towards VSDS electric motor drivers. In the latter case, the power required is provided by a centralized power plant, and it is expected that the reliability of the system can be upgraded from approximately 340 days/year towards 360 days/year.

André Legall

Session chairmen & visiting GPA officials, Gene Thomas and Mark Sutton flanked by the speakers

Site Visit

Siemens Compressor Manufacturing Facility

Friday morning, 40 bleary eyed GPA Europe members clambered aboard a coach and settled down to snooze on the journey from Bonn to Duisburg to visit the Siemens Compressor Manufacturing Facility. At 10 am, suitably badged, we were refreshed by excellent coffee and cake to settle down to learn about the great strides that Siemens have made to become a serious player in the LNG and Gas Processing Compressor and Driver markets. Ralf Kannerass welcomed us and introduced Max Pirkl who gave an overview of the developments Siemens have made in the past few years.

The factory is on the former Demag Delaval Gmbh site which Siemens acquired in 2001, located on the Rhine in Europe's largest inland port. Siemens are making significant investments (€130M) to develop the factory into a modern manufacturing and test facility. The new Mega Test Centre, where full load, full speed, full pressure testing of LNG, GTL, Ethylene and Syngas machinery will be undertaken is under construction. Operational as of February 2008, the facility will have capacity for full string-testing of up to six trains in parallel ensuring uncompromising reliability of compressor trains before being shipped. Different driver options are as follows:

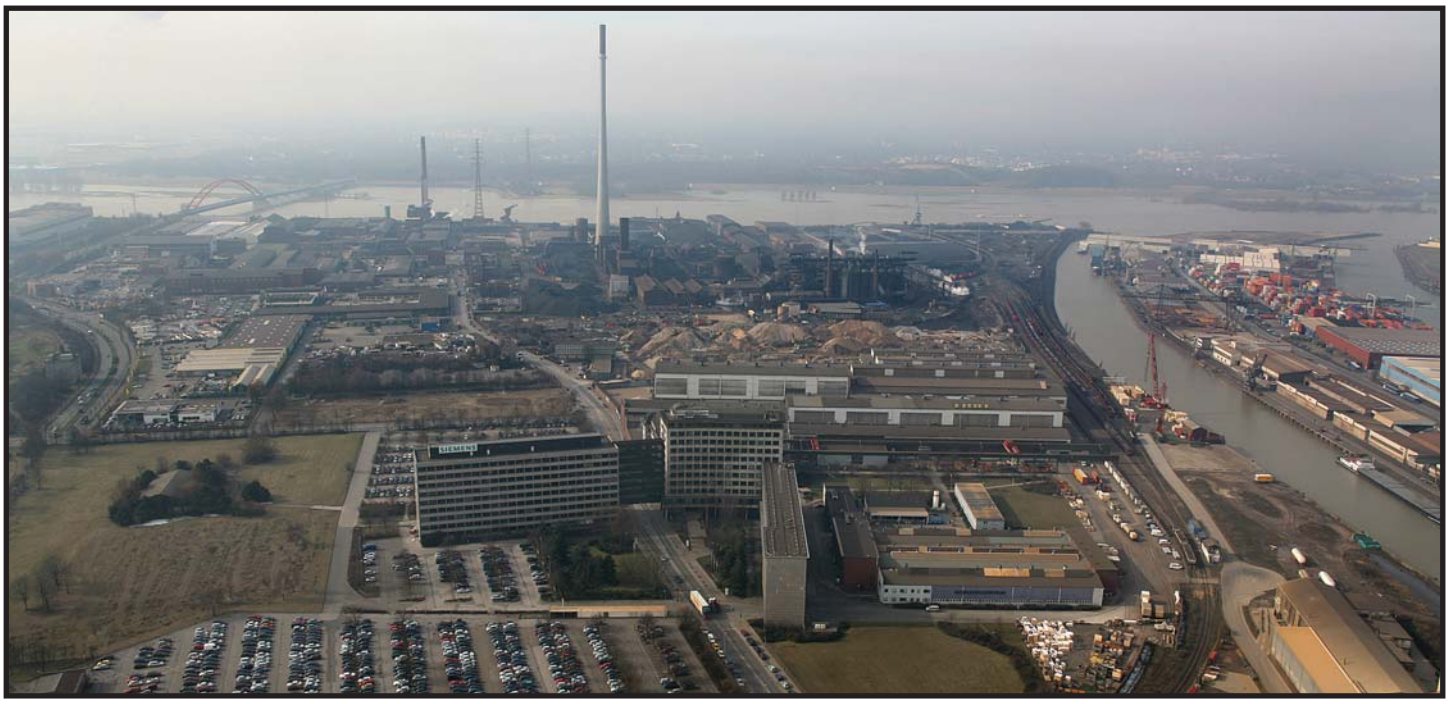
- Electric motors up to 100MW
- Steam Turbines to 100barg and 35MW
- Gas Turbines to 140MW

Siemens employ over 2000 people at this site which has 42,000m^2 of manufacturing space and has a capacity of up to 150 units a year. Siemens make a wide range of compressors including:

- Centrifugal (horizontally split and barrel)
- Axial
- Combined axial/centrifugal
- Integrally geared compressors

The company is making a major effort to become a key player in Gas Processing and LNG and plan to

Site Visit to Siemens Compressor Manufacturing Facility



Aerial view of the Siemens Compressor Manufacturing Facility and Environs

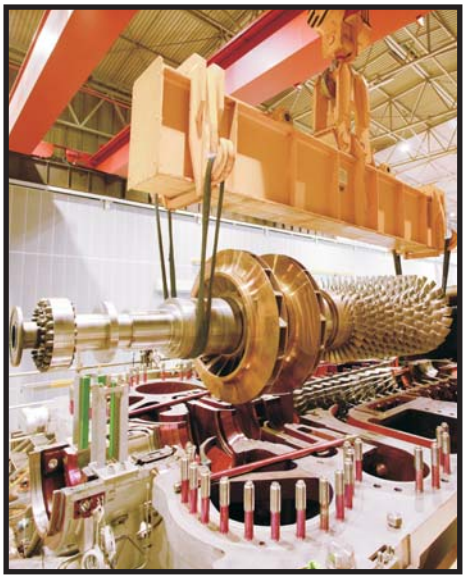
build on their successful track record in Petrochemicals, particularly Ethylene plants, which utilise similar refrigeration systems to to those in LNG plants. Siemens have supplied compressors for various duties in LNG facilities including End Flash compressors and Boil off Gas compressors, particularly on export terminals and a recent import terminal in Mexico.

Siemens' recent acquisition of Alstom Industrial Turbomachinery (2003) together with their core electric motor business puts them in a strong position with respect to the supply of drivers and power generation machines. They were one of the first to supply large electric drives for gas processing with a 22MW machine for NAM and 5 x 40MW VfD motors on the pipeline compressors for the Troll land project. Last year saw the start up of the Statoil's Snøhvit LNG facility at Hammerfest, where 3 x 65MW VfD motors power the refrigeration compressors. Siemens have now customised the design of some machines in their gas turbine range and can offer machines up to 47MW for compressor drivers.

Following the introduction, the GPA members toured the site and were fascinated by the size and complexity of the manufacturing facility. On view were several examples of the Integrally Geared machine, a novel concept for many of the gas processors, but a machine which apparently offers great flexibility. The scale of the investment was clearly demonstrated with several new milling machines including one with a capacity of 300tons. Several compressor strings were installed in the existing test facility and we viewed the new facility with some respect.

Siemens concluded the tour with a buffet lunch and a chance to network before rejoining the coach for a quick trip back down the Rhine valley to Dusseldorf Airport and then to Bonn. In summary, an excellent trip and our thanks go out to Siemens for being such generous and interesting hosts.

John Sheffield



All photos on this page courtesy of Siemens

The Poseidon Adventure - Take 3

The original *Poseidon Adventure* film, which was made in 1972, was the top grossing movie of that year and received critical acclaim. It was about the capsizing of a luxurious ocean liner by a tidal wave and the desperate struggles of a handful of survivors to journey up to the bottom of the hull of the liner before it sank.

The plot centred upon the fictional ocean liner *SS Poseidon*, an aged luxury ship from the golden age of travel, on its final voyage from New York City to Athens before being sent to the scrapyard. On New Year's Eve it was overturned by a tsunami wave caused by an underwater earthquake, trapping passengers and crew inside. A renegade preacher attempted to lead a small group of survivors to safety.

MV Poseidon

It was therefore with some fear and trepidation that the 140 guests, booked for the Conference Dinner in Bonn on Thursday 27th September, set out for their evening's pleasure. We were to sail at 19.30 hrs on the **MV POSEIDON;** it was not only the name of the boat that maybe worried us, but we were sailing from **Pier 13!**

However everyone took a stiff upper lip attitude and with fortitude stepped out from the hotel to cross the road to the boat. This journey, short though it was, was made more comfortable by the Hilton Hotel management making 50 of their corporate umbrellas available to us since to say it was raining was an understatement.

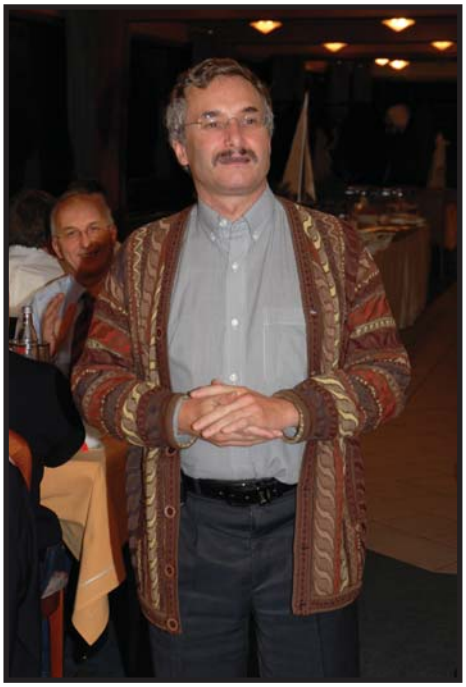
Although it was not New Year's Eve we were greeted on board with pre-dinner drinks of the excellent local Sekt sparkling wine which was kindly sponsored by TGE Gas Engineering.

The MV Poseidon was launched in 1996, is 45m long, 10.5m wide with a draught of 1.25m. The propulsion package is a "Deutz" marine diesel engine with a power rating of 200KW at 1800 RPM. These compact dimensions and flexible service concept are ideal as the boat plys up and down the Rhine passing under many low bridges carrying up to 200 passengers at a time.

After the pre-dinner drinks, with everyone now at ease and dry, a buffet dinner was served whilst we sailed down the Rhine towards Bad Godesburg and Remagen. The excellent food was provided by the Hilton Hotel, two members of their restaurant staff were assigned to the boat to help with the logistics of serving and everyone seemed to tuck in heartily (this always seems to happen at GPA Europe Functions).

We sailed past Konigswinter, The Drachenfels, Bad Honnef past the famous remains of the bridge at Remagen (might be another film story there), finally making our turn at Linz. These location names are dropped out by one who used to live in the area for the benefit of all

Conference Dinner with a nautical theme



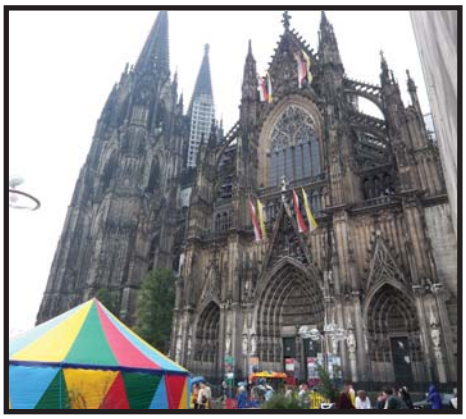
Vote of thanks from the Chairman

people on board because the weather was so bad no one could see out of the windows. In fact it was suggested that we should have held the Conference during the evening and sailed down the Rhine during the day. We must bear that in mind for future meetings.

Finally, smack on the dot at 23.00 hrs, we arrived back at the mooring (Pier 13) and thanks to the electro - hydraulic steering system with a specially developed control lever feature, we made a simple and precise stopping of the vessel avoiding the "lateral breakaway" phenomenon which is usually inherent with single steerable units.

A few of our "flow assurance engineers" then set out to put this multi-discipline activity to test in the bar, other less hardy souls went quietly to their beds.

I am sure most of you are wondering why this article was headed "Take 3". A sequel, "*Beyond the Poseidon Adventure*" was made in 1979. This had an equally star-studded cast, but was a box-office and critical failure. So here goes for "*Carry on Even Further Beyond the Poseidon Adventure*". *Don Cooney*



Cologne Cathedral

Brollies Out!

Companions' Tour

9.00 am prompt the bus arrived - the heavens opened and it poured with rain - all day!

Undeterred, we drove from Bonn to Cologne and began the day at the Roman-Germanic Museum (next door to the Cathedral). The mosaics and exhibits covering every aspect of Roman life were discovered in the City in 1941 during excavations for an air raid shelter. This museum is a must for anyone with the slightest interest in Roman history and well worth a visit.

However, this was a day when the best laid plans of mice and men, etc... and the original plan for a guided tour of Cologne Cathedral was not going to be possible as a children's pilgrimage had been arranged for that day. Noting our disappointment our Tour Guide suggested that instead we could walk The Pilgrims' Way through the Cathedral. This leads you through the south portal to the Milan Madonna and to the Shrine of The Three Holy Kings underneath which all the pilgrims pass. Children packed the Cathedral, some carrying banners, and all being blessed. Candles glimmered and together with the magnificent organ music, in all honesty no planned guided tour could possibly have been as atmospheric. It was easy to forget that outside it was raining and windy, but as we emerged from the Cathedral we were greeted by smiling children offering us their home-made cakes, for which we were very thankful, and ate huddled together underneath our umbrellas.

We then drove to the Ahrtal for lunch in the Adenbachhuette, sampling their delicious home cooked regional specialities. The views were probably stunning but still it poured (why do I keep thinking I'm in Wales?). However, the log fires, wonderful food and red wine cheered us up.

The planned after-lunch walk through the vineyards and down into Ahrweiler had to be abandoned because of the bad weather and instead the bus took us down for a tour of the old medieval part of the town. Even from underneath umbrellas it was picturesque.

We ended the tour at the Winegrowers' Co-operative in Ahrwweiler where we were treated to delicious coffee and cakes and then invited to try the speciality Federweisser (young wine). We had been warned in an email from Peter Meyer to be careful with the Federweisser - so naturally we restrained ourselves to one small glass! Delicious.

By the way, it was still pouring with rain, but by now we didn't care! Eighteen soggy but happy ladies returned to Bonn! *Wendy Cooney*

The Companion's Tour in the dry at the Winegrower's Co-operative, Ahrwweiler

AGM Knowledge Session, London

The Knowledge Session, held in London to accompany the AGM and technical meeting, was presented by Mike Considine of BP International Limited. The session, entitled *Assessment and Management of Major Accident Risk (MAR),* was attended by approximately seventy engineers ranging from senior management to new graduates. The presentation was split into three main areas:

- Introduction to Major Accident Risk,
- Frequency,
- Consequence and Risk, Risk Criteria and Risk Management.

The first part of the session, *Introduction to Major Accident Risk*, looked at examples of major accidents, including the Piper Alpha disaster in 1988 and some more recent examples such as the Texas City Refinery incident in 2005. This gave a clear overview of the impacts that accidents have on businesses. Mike also included a number of brief descriptions of some tools that are used for addressing major accidents, e.g. procedures, HSE Management Systems and lessons from previous accidents.

During the presentation, Mike described how and why the terms

Mike Considine

Frequency, Consequence and Risk are used when discussing accidents. He illustrated this by describing how methods, such as analysis of historical data, can be used to predict the frequency of an accident, the potential consequences using consequence modelling, and the use of techniques such as risk matrices to quantify risk.

For the final part of the session Mike gave an overview on the role of risk criteria and risk management, with particular application to major accidents. To explain how risk criteria can be defined, Mike referred to a number of factors, including societal and individual risk criteria. Individual risk criteria establishes a minimum level of protection for every individual, whereas societal risk criteria focus on accidents which pose the greatest concern to society and threat to the company. Mike highlighted the importance of successful Risk Management as a way to ensure continuous risk reduction. This includes how continuous risk reduction can be achieved during the front end engineering and detailed design stages and will ensure that individual components of risk are managed in a prioritised and consistent fashion.

Mike knowledgably answered many questions that were posed, both during the presentation and at the Q&A session, allowing the audience to gain a deeper understanding from the presenter's experience of assessment and management of major accident risk.

Jill McCormack

AGM Technical Meeting - Safety Issues

The Technical Conference on "Safety" featured two presentations that aptly complemented the morning knowledge session. The first presentation was allocated a full hour as the GPA was fortunate to secure Mike Broadribb, distinguished advisor on Process Safety at BP and author of the investigation into the 2005 Texas City isomerisation unit explosion. Mike introduced his paper, *Lessons from Texas City - A Case History*, by explaining that BP wanted to share their experience - the Texas City incident provided many critical lessons of how failures in process design and operation, coupled with management limitations and lack of a safety culture, culminated in a fatal explosion.

The incident raised fundamental questions as to how clear deficiencies were allowed to develop in the first place and why actions had not been taken. The incident had been entirely preventable.

The incident occurred on the isomerisation unit involving the raffinate splitter, blowdown drum and vent stack. The splitter fractionates an aromatics free stream and produces C_5/C_6 overheads and C_7/C_8 bottoms. During upsets or shutdowns, vapour is disposed of to a blowdown drum and stack, with any liquids being pumped away.

On March 23rd 2005, during start-up of the raffinate splitter, an explosion and fire occurred which killed 15 persons and injured over 170. Many of those killed or injured were in temporary trailers that were being used for the turnaround of an adjoining unit. This location had been regularly used before. The largest trailer was about 50 metres from the base of the vent stack and this was where most fatalities occurred. Within 24 hours an investigation team was in place to determine the root causes of the

Mike Broadribb

AGM Technical Meeting - Safety Issues

A new venue for the London AGM and Technical Meetings

incident, make recommendations to avoid reoccurrence and identify the lessons learned.

Mike gave a detailed description of the incident, including the relevant failures in process instrumentation, failure to follow correct operating procedures and lack of operator attention, lack of communication and lack of supervision.

The raffinate splitter was started up without clear reason (the rest of the isomerisation unit was several days from being ready). Not all checks may have been completed. The night shift of March 22nd commenced charging cold feed to the column and left the base full of liquid. There was no effective handover to the day shift. During the morning they ran the feed charge pump so the column would have been over 80% full of liquid when the pump was stopped.

The hot heavy bottoms exchanges heat with the feed and, upon opening of the column bottoms valve, heating of the feed caused rapid liquid vaporisation in the column. This dumped the liquid inventory into the blowdown drum and vent stack. A vapour cloud formed at the vent stack, which was ignited, probably by a diesel truck. The resultant explosion severely damaged the trailers, leading to the 15 deaths and the extensive number of injured. No evacuation procedure had been initiated or any alarm raised.

The investigation showed there had been "near-misses" in the past but there was minimal data or record keeping to assist in learning lessons from such occurrences. There had also been opportunities on previous revamp projects to replace the atmospheric blowdown drum and to tie-in the column relief system to a closed header, but this had not been undertaken.

A series of management system causes were identified for each key issue that led to the incident - loss of hydrocarbon containment, lack of proper operator procedures, control of work and trailer siting, and the design and engineering of the vent system.

A number of "lessons learned" were derived from delving deep into the underlying cultural issues so as to identify recommendations that would prevent any reoccurrence of such an incident. These lessons are applicable right across the process industries:

- A lack of clearly defined business priorities. No clear view or ownership of key priorities. Lack of adherence to procedures
- Safety not a priority in terms of management goals, culture or values. Lack of focus on risk reduction
- Organisational complexity led to lack of clear accountabilities and extensive interfaces. Poor communication led to worker confusion, low morale and poor performance. Low investment in manager development and poor teamworking
- Inability to see risk. People accepted levels of risk considerably higher than comparable installations. Many examples were observed by the site investigation team, including the large number of vehicles left close to hydrocarbon processing units and the extensive use of trailers. There was no culture of hazard identification
- Lack of early warning. No clear focus on the indicators for potential catastrophic or major incidents. Systematic problems with work practices. Poor communication, poor auditing and lack of follow-up of agreed objectives. Safety measures did not deal with fundamental process safety.

The investigation report identified a large number of recommendations specific to the refinery and the

The Presenters with Session Chairman, Adrian Finn

isomerisation unit in particular. These could be summarised as "human issues" - the development of people, skills and behaviour, "operation" including better, safer plant design, inspection and verification as well as the moving from site of non-essential staff, and "refinement and implementation of HSSE policies" including keeping vehicles off site.

The problems at Texas City culminated over a number of years and will take much effort and commitment to overcome. A report by James Baker highlighted the need for change management, notably in leadership, integrated process safety management systems, greater process safety knowledge and use of expertise, and the need for a process safety culture. The lessons are vital learning for the whole BP group.

The audience were deeply appreciative of Mike's clear and lucid explanations and his detailed insight of all the key factors involved in the Texas City incident.

Graeme Ellis, Senior Safety Consultant at ABB Engineering Services, did an excellent job in rounding off the day with his presentation on *Identification of Major Accident Hazards*. He started by highlighting accidents at the Buncefield Oil Storage Depot in December 2005 and the ICI Urea plant at Billingham in 1989.

Buncefield caused the largest peacetime fire ever in the UK and highlighted issues in the integrity of the oil containment tanks, in emergency preparedness and in land use planning. It was fortunate that the explosions commenced about 0600 on a Sunday morning or else many fatalities could have occurred. The mechanism by which a vapour cloud could be formed from oil leakage had never been envisaged or evaluated and is still unclear; splashing of liquid over the top of the holding bund and the fact that the fuel was relatively high in volatile butane may have been instrumental. The blast overpressure that occurred has been assessed at 20 times what would have been expected from experience and predictive techniques. Buncefield raised fundamental questions over lack of adequate monitoring by operators, lack of testing of safety critical trips and whether the consequences of incidents were understood and properly mitigated?

Rupture of a large reciprocating ammonia pump at the ICI Urea plant resulted in two deaths. Questions were raised at the time over the regularity of inspections, why there was no accessible isolation valve to stop ammonia leaking to atmosphere and why there was no satisfactory toxic refuge point for plant operators.

These two incidents highlighted common features across process industry accidents - loss of containment that result in fires, explosions or toxic release with the potential for injuries and death. It was argued that there are always several root causes that are predictable and often human related. Incidents tend to occur during non-routine activities and have similarities with previous incidents ("near-misses") that have not been learnt from. Graeme noted that many safety management systems focus on performance measures and occupational safety and aim to avert high probability incidents. These management systems do not necessarily focus enough attention on avoidance of very severe process hazards.

Periodic Safety Reviews, undertaken by a team of operations and engineering personnel, are

Graeme Ellis

geared to existing operations and are now utilised by many companies. ICI commenced using Process Hazard Review (PHR) techniques in the aftermath of the deaths at the Billingham urea plant. Such reviews provide a structured methodology that, akin to HAZOP, utilises guidewords to focus on risk evaluation and the reduction of risk to as low as reasonably practicable. PHR can provide a prioritised improvement plan, the effect specific scopes of work will have on improving process safety and therefore the necessary expenditure to meet defined safety objectives. Such reviews are mandatory for COMAH (Control of Major Accident Hazard) sites and Graeme gave an example of how the approach had been used by a UK onshore oil reception COMAH "top tier" site.

Adrian Finn

Assessing the Morning Session

GPA Europe Chairman's Report 2007

Ladies and gentlemen, colleagues and fellow members of the Gas Processors' Association, Europe. It is my pleasure to make the Chairman's presentation to the 2007 Annual General Meeting. I have been Chairman of the GPA Europe for one year and, as it is by tradition a two-year appointment, you will see me around for one more year as your Chairman.

Earlier this year, in March, I was in San Antonio to represent the GPAE at the annual convention of the GPA US. I co-chaired a session on international developments in gas processing with Nicholas Bracho from the Venezuelan Chapter. During this conference we had a meeting with representatives from our sister GPA organisations and we decided to create an international forum with the aim to strengthen the bond between the sister GPA organizations and to enhance cross-fertilization between us.

I can say that our association had another excellent year, for which I would like to thank the members of the Management Committee, who were available to give direction to the GPA in various matters. I also want to thank the members of the Programme Committee who ensured that the meetings and events of the GPA Europe were a success.

One point I would like to make, the organisation of the events we had in the past year was only possible with the support from our dedicated and effective management office. From here I would like to thank Don Cooney for his effective service to the GPAE.

The smile that says the finances are sound

Ed Bras, the Chairman, guides the AGM with Christine Etherington

It is also, however, my duty to say farewell to members of the committee who have decided to resign their position. Brian Marshall, who has been a staunch member of the GPA since 1980, has resigned from the Man Com as well as the Programme Committee. I would like to spend a few words thanking him, because Brian has been one of these very active members who will be missed. Most of us know him as the organiser of our conferences, a role he filled for many years. Associated with that he organised our golf tournaments. He was also Vice-Chairman of the GPSA for a period of 2 years and he was Treasurer of the GPAE. Also he was an appreciated member of the Man Com; he is one of those persons who can give a meeting that lively touch. Finally we should not forget his role in setting up the GPAE website and he was instrumental in setting up the knowledge sessions. He leaves with our thanks, gratitude and best wishes for the future and I hope that he will turn up at our meetings or golf tournaments.

I am also pleased to welcome Adrian Finn (Costain Oil, Gas and Process) who has agreed to join the Man Com if elected. We know Adrian already for a long time as a very active member of the Programme Committee, where he has been always available to ensure an interesting programme at our conferences.

We have had very successful meetings during the year. We started the year in February in Paris, where we had over a hundred delegates attending the conference covering the topic "LNG and associated gas treating". The meeting was preceded by a knowledge session covering the topic "Mol sieves in gas processing". In May we had almost eighty delegates attending our conference in Teesside. This meeting covered "Operations and Maintenance" followed by a site visit to the gas processing plant at Teeside. Our Annual Conference this year in Bonn dealt with the topic "GTL and CO_2 Capture" and was attended by 105 delegates. This meeting was preceded by a knowledge session on "SIL assessment" and the meeting was followed by a site visit to the SIEMENS Manufacturers facility. In Bonn, we were also pleased to have the company of Gene Thomas and Mark Sutton from the GPA in USA.

In spite of everybody's busy schedules, attendance at our conferences has been very high and I understand that for today we even had to waitlist members.

Those of you who were at our events, will you please join me in congratulating the Programme Committee on the organisation of these very successful conferences. For those of you who were unable to attend this year, I hope I can welcome you next year. I also would

like to thank you, members of the GPA, for your contributions, since good conferences need quality papers, which you have been supplying in the past and I trust that you will continue to do so in the future. In particular I would like to mention the success we have had with our knowledge sessions and we plan to continue these. I am sure you also agree with me that we have been successful in setting up meetings that meet the demands of our members and the industry and we will continue to develop the GPA Europe as a premier networking opportunity for our industry.

I am pleased to see that our European coverage is very good; almost all European countries are represented at our conferences.

Membership numbers are rising and we have now 110 corporate and 224 individual members, which is about 10% up from last year's figures. Since last year we have included a "Premier" membership level that has been taken up by 12 companies, which allows those companies to appoint up to 8 people to attend our events at membership rates.

I am probably not telling you something new when I say that we have a website, but did you also know that we have renewed and improved it? By monitoring the number of 'hits', we know that the site is already very popular. If you haven't visited our website recently, I can recommend you do so.

Some final remarks I would like to make about next year. In 2008 we will be celebrating our 25th anniversary and we have decided that the highlight event of the year will be the Annual Conference to be held in Paris, where our first conference was held in 1983. Preparation for the 2008 Annual Conference is already in full swing and it promises to be a great event with keynote speakers, special paper sessions and, of course, great entertainment! The dates for the Annual Conference in 2008 are 24-26 September and I suggest you block these out in your diaries!

Ladies and gentlemen, thankyou for your continuing support of the Gas Processors' Association Europe. It is your association and I and the other members of the committee feel privileged to be able to represent your interests in the operation of the GPA Europe. Please however, do not hesitate to let us know if there is any way that the Association can help you in networking or providing more information and experiences to help you support the gas industry in Europe.

Ed Bras

The Officers of the GPA Europe for 2008

Chairman:	Ed Bras (Shell Global Solutions)
Deputy Chairman:	Justin Hearn (BASF)
Hon. Secretary:	Tim Goodhand (WorleyParsons)
Treasurer:	Christine Etherington (Forcom International)

Management Committee members for the year 2008:

Nicholas Amott	Fluor Ltd.
Colin Biggs	Consultant
Ron Coultrup	Forcom International
Sandy Dunlop	AMEC
Adrian Finn	Costain Oil and Gas
Jean-Claude Garcel	Total
Phil Hagyard	Technip
Malcolm Harrison	Foster-Wheeler
Matthew Humphrys	Johnson Matthey
Murtaza Khakoo	BP Exploration
David Linnett	Consultant
Graham Robinson	Business Solutions
John Sheffield	John M Campbell
Christian Streicher	Prosenat
Sigbjørn Svenes	Statoil
David Weeks	M W Kellogg

Ex-officio members of the Management Committee are:

Membership Secretary:	Paul Seccombe	Invensys
Programme Committee Chairman:	Lorraine Fitzwater	Petrofac Eng

HOW TO PROPERLY PLACE NEW EMPLOYEES

1. Put 400 bricks in a closed room.
2. Put your new employees in the room and close the door.
3. Leave them alone and come back after 6 hours.

Then, analyse the situation:

a. If they are counting the bricks, put them in the Accounting Department.
b. If they are recounting them, put them in Auditing.
c. If they have messed up the whole place with the bricks, put them in Engineering.
d. If they are arranging the bricks in some strange order, put them in Planning.
e. If they are throwing the bricks at each other, put them in Operations.
f. If they are sleeping, put them in Security.
g. If they have broken the bricks into pieces, put them in Information Technology.
h. If they are sitting idle, put them in Human Resources.
i. If they say they have tried different combinations and they are looking for more, yet not a brick has been moved, put them in Sales.
j. If they have already left for the day, put them in Marketing.
k. If they are staring out of the window, put them in Strategic Planning.
l. If they are talking to each other and not a single brick has been moved, congratulate them and put them in Top Management.
m. If they have surrounded themselves with bricks in such a way that they can neither be seen nor heard from, put them in Government.

Watch for the warning signs of spending too long on the computer!

New Corporate Members

Welcome to our new Corporate Members in January 2008

Level 1 PREMIER

Compressor Controls Corporation, Bracknell, UK
Compressor Controls Corporation (CCC) has specialized in turbomachinery controls for over 30 years. They serve customers in a broad range of industries including oil, gas, chemical, petrochemical, refineries, LNG, pipelines, steel mills, pharmaceutical, machine-building, and power generation facilities. They also construct new turbomachinery controls and retrofit existing equipment.

Jacobs Engineering, London, UK
Jacobs Engineering Group Inc. is one of the world's largest and most diverse providers of professional technical services. With annual revenues exceeding $8 billion, they offer full-spectrum support to industrial, commercial and government clients across multiple markets. Services include scientific and specialty consulting as well as all aspects of engineering and construction, and operations and maintenance. Their primary markets include: Oil and Gas and Refinery Sectors.

StatoilHydro, Norway
Established on 1 October 2007 following the merger between Statoil and Hydro's oil and gas activities the company now has 31,000 employees in 40 countries. It is the world's third-largest net seller of crude oil and one of the world's largest gas suppliers. StatoilHydro is the world's largest operator of deepwater fields, leading the world in the use of deepwater technology and in carbon capture and storage. Although both Statoil and Hydro Oil and Gas were both Level 1 members previously, the new combined company has upgraded to PREMIER Grade.

Level Two

Criterion Catalysts and Technologies, Houston, USA
Criterion is an international company that supplies catalysts, process technologies and catalyst services for a wide range of refining applications. They have more than 50 years' experience developing, manufacturing, testing, marketing and servicing catalysts that are used in every type of hydroprocessing operation. They offer a variety of process technologies that can be packaged with our catalysts to create a complete, optimized solution for any hydroprocessing problem or supplied independently.

Escher Process Modules, Schiedam, Netherlands
ESCHER designs and supplies a comprehensive range of equipment for processing and conditioning of natural gas and hydrocarbon liquids. Processes include gas / liquid dehydration and regeneration units (using glycol MEG, DEG, TEG), desiccants (molecular sieves, silica gel), low temperature separation (LTS), 2 / 3-phase separators, fuel gas packages, metering skids, etc.
ESCHER has a long experience and impressive track record in the supply of integrated skid mounted systems and process packages from the project proposal stage through process design, detailed engineering, project management, procurement and fabrication to turnkey installation and commissioning.

I-V Oil and Gas BV, Papendracht, Netherlands
I-V Oil and Gas is a multidisciplinary engineering company. Its range of services encompasses projects in the oil and gas industry at both onshore and offshore (fixed or floating) locations. The capabilities range from feasibility studies to turnkey contracts, including project management, engineering and design, procurement, construction and commissioning activities. The company is founded as an independent consultant for services in this special market and provides advice, process know-how, procurement services and project management for national and international clients. Services are provided to both oil and gas and construction companies.

Newpoint Gas Services, College Station, USA
Newpoint Gas, Inc, have experience in all areas of natural gas treating and gas processing. This experience allows them to offer producers solutions for their natural gas needs. Experience includes equipment installation with startup support and training. Newpoint also provides contract gas treating services in which they furnish all equipment and operations that are required to meet sales gas specifications. Special areas of expertise include Arsenic Treating and Removal, Amine Treating, Pressure Swing Absorption (PSA), Oxygen (O_2) Removal, and Helium Purification in the United States since 1994.

Pietro Fiorentini, Milan, Italy
Since its foundation in 1940, Pietro Fiorentini is constantly growing and today the Company is an international market leader offering a wide range of products and services that covers all the needs of modern Oil and Gas Industry. Equipment and treatment plants for gas and liquid hydrocarbons and conditioning in the Oil and Gas market, plants for gas transmission, gas conditioning systems for power plant, equipment and components for gas distribution as well as equipment and components for final civil and industrial users.

Call for Papers

For 2008 Conferences...

Ashford, Kent - May (LNG)
Paris - September our 25th Anniversary
(Looking at the next 25 Years topics to include Upstream and Midstream Developments , HSE and Commercial considerations)
London - November

...and already arranged for 2009

London - February
Barcelona, Spain - May

Our meetings provide a forum on neutral ground where the users, contractors, consultants and specialists can meet together to receive and discuss relevant technical papers and network informally with their peers.

Papers on any aspect, technical or commercial, of the gas processing industry are requested and contributions from both operating companies and suppliers will be particularly welcome. Papers may be offered by both members and non-members. Interested parties are requested to provide a title and abstract (100-200 words) as soon as possible. Please include your full mailing address, e-mail address, phone and fax number.
Paper selections will be advised in good time to enable preparation of the paper. Details for the presentation will be given to the speaker after the selections are made. Abstracts and other information should be sent to the Administration Office:

GPA Europe, 10 Shetland Way, Fleet, Hampshire GU51 2UD
email: admin@gpaeurope.com facsimile: 01252 786260

Can you help us to provide better technical meetings and conferences?

FORTHCOMING EVENTS

February 20th - 22nd 2008
Amsterdam, Netherlands - Residental
Gas Treating Conference and Knowledge Session

- Day 1
  - Registration
  - Welcome Reception sponsored by:

- Day 2
  - All Day Technical Session
  - Conference Dinner
- Day 3
  - Knowledge Session

Binders sponsored by:

14th-16th May 2008
Ashford, Kent, UK - Residential
LNG Topics

Day 1
- GPAE Golf Tournament

Day 2
- All Day Technical Meeting

Day 3
- Isle of Grain site visit

24th-26th September 2008
Paris, France - Residential
25th Anniversary
Annual Conference

Day 1
- pm Knowledge Session
- Welcome Reception

Day 2
- Keynote Speakers & Panel Discussion
- Technical Conference
- Gala Conference Dinner

Day 3
- Technical Conference

20th November 2008
London, UK
- Knowledge Session
- AGM
- Technical Meeting

CONTACT DETAILS
GPA ADMIN OFFICE

GPA Europe,
10 Shetland Way, Fleet,
Hampshire GU51 2UD, UK

T: +44 (0)1252 625542
F: +44 (0)1252 786260
E: admin@gpaeurope.com
W: www.gpaeurope.com
Contacts:
Don and Wendy Cooney

GPA EUROPE

CORPORATE MEMBERS

This listing of current Corporate Members represents the status as at the end of December 2007. All companies are UK based unless otherwise stated.
In addition there were 215 Individual Members

Corporate Level 1 PREMIER (12)

Advantica Technologies Ltd		**Jacobs Engineering**	
BASF - Aktiengesellschaft	**Germany**	**M W Kellogg Ltd**	
BP		**PBG SA**	**Poland**
Costain Oil, Gas & Process Ltd		**Shell Global Solutions Int BV**	**Netherlands**
Fluor Ltd		**Technip**	**France**
Foster Wheeler Energy Ltd		**Total**	**France**

Corporate Level 1 (35)

ABB Engineering Services		Nalco Ltd	
ABB Lummus Global BV	Netherlands	NORIT Nederland BV	Netherlands
Air Products Plc		OAO TNK-BP Management	Russia
AMEC Group Ltd		Petrofac Engineering Ltd	
Amines & Plasticizers Ltd	India	Saipem SA- Energies	France
AspenTech Ltd		Sazeh Consultants	Iran
Bechtel Ltd		Shaw Stone and Webster	
BG- Group		Snamprogetti SpA	Italy
CB & I John Brown Hydrocarbons Ltd		Statoil ASA	Norway
CECA SA	France	Sulzer Chemtech Ltd	Switzerland
Eni Div E&P	Italy	Taminco	Belgium
ExxonMobil North Sea Production		Techint SpA	Italy
Grace GmbH & Co KG	Germany	Tehran Raymand Consulting Engineers	Iran
Hydro Oil and Energy	Norway	Whessoe Oil and Gas Ltd	
ILF Consulting Engineers		Wintershall AG	Germany
Johnson Matthey		WorleyParsons	
Kellogg Brown & Root		York International	
Koch-Glitsch (UK) Ltd			

Corporate Level 2 (58)

Able Instruments and Controls Limited		Juran Institute	Netherlands
Alderley plc		Mott MacDonald	
Apix Consulting Limited		MSE Consultants Ltd	
Atkins Oil and Gas		Nordon Cryogenie	France
Atlas Engineering UK Ltd		Oil & Gas Systems Limited	
Axsia Howmar Ltd		PCC Sterling Limited	
Barela International Group		Peerless Europe Ltd	
BASF Catalysts	Germany	Penspen Ltd	
Bryan Research And Engineering	USA	Perry Equipment Ltd	
Cameron Petreco Process Systems		Petrogas International BV	Netherlands
Chart Heat Exchangers LP		Procede Group BV	Netherlands
Davy Process Technology Ltd		Prosernat	France
DtEC Site Services		PS Analytical	
E.I.C. Cryodynamics Division		Purvin and Gertz	
Energy and Power		QuantityWare	Germany
E.ON UK		Siirtec NIGI	Italy
Escher Process Modules	Netherlands	Snamprogetti Ltd	
Exterran (UK) Ltd		Sterling Thermal Technology	
Frames Process Systems BV	Netherlands	Stork Protech (UK) Ltd	
Gaz de France Produktion Exploration		Technip KTI SpA	Italy
Deutschland GmbH	Germany	Teknika (UK) Ltd	
Granherne Ltd		Twister BV	Netherlands
Gusto BV	Netherlands	TGE Gas Engineering GmbH UK Branch	
H.A.T. International		UOP NV	Belgium
Heatric		Vetco Aibel	Norway
IMA Limited		Weir LGE Process	
Invensys Process Systems (UK) Ltd		WinSim Inc	USA
ISG	Italy	Zeochem	Switzerland
John M Campbell & Co	USA	Zeta-pdm Ltd	

Corporate Level 3 (6)

Abbey Industrial Sales Co Ltd	OAG Energy Consulting Ltd
Infochem Computer Services Ltd	Softbits Consultants Ltd
McMurtrie Limited	Toromont Energy Systems Ltd

Academic Level (1)

NTNU	Norway

Please persuade your company to join the GPA Europe and help support our activities.

Printed by Copyzone, Bishop's Stortford, Hertfordshire. Tel: 01279 657769 Web: www.copyzone.co.uk